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TENDENCIES IN POWER-PLANT DESIGN.

No extended study of recent power-plant designing practise is necessary to demonstrate conclusively that the arrangement and composition of stations of widely varying capacities are to a large extent responsive to the trend of engineering development in installations of great magnitude. The electrical industry as a whole is growing at so rapid a rate that the latest types of equipment and the most advanced combinations of apparatus are constantly demanded, regardless of the size of the community served. Unquestionably the expansion of high-tension power-transmission systems has had much to do with this, for in the earlier days of the central-station business the field was so essentially local in character that plants had to be built with chief regard to immediate markets rather than planned for continuously increasing service demands over a long period of years.

Now we are in the midst of a development of central-station service which is beyond the imaginations of only a few years ago—a service which carries economic benefit to distant and widely separated communities formerly provided with facilities of only the crudest kind, and one which is gradually tending to equalize both rates and service rendered throughout so broad an area that the farm itself is rapidly acquiring all the electrical agencies which have in the past been so exclusively associated with city life. This opportunity for expansion means that every new generating station designed along genuinely broad lines sets a standard of construction which hints still larger usefulness in the future; it means also that provincialism finds it more and more difficult to acquire a hold in the establishment of new or improved generating and substation facilities; and it is a source of congratulation that so much of the latest work bears evidence of such far-sighted appreciation of the ultimate possibilities of electric distribution.

Three features of power-plant design are conspicuous at the present time on account of their influence upon ultimate development. Probably the raising of line voltages has been the chief factor in station evolution, for without the widening of the field of commercial distribution there would be little incentive for the installation of generating units of present capacities. Closely associated with high-voltage work, the steam turbine has brought about a remarkable change of front in the generating plant, and last-

ly, the dual use of high potentials and generating units of great capacity has forced power-plant designers to adopt methods of current control within the station which combine speed and safety of handling, even if the cost of apparatus for switching and measurement tends to reach a heavy total in every plant of considerable size which breaks away from the old methods and appliances which served reasonably well in cases where the service could be maintained successfully by manual operation.

One of the best features of the present situation is the amount of space available in plants located outside the centers of cities, and transmitting power to thriving communities without excessive loss. With few exceptions the later plants are allotting ample space to all apparatus concerned with the use of high voltages. Little is known as yet about the relation of wire spacing to building cost, for instance; but as the value of service rendered grows upon a station, mere building cost is bound to shrink in importance, especially in the suburban districts or on water fronts where land is not as valuable as in the localities where the original plants were forced to locate on account of the limitations of voltage then prevailing. Everybody knows how the turbine-driven generator disports itself in an area so small that a steam engine cannot for a moment compete with it on the basis of capacity per unit area, and while the auxiliary equipment necessary to secure any kind of economy in the operation of a turbine demands a good deal of space in proportion to its capacity, recent methods of condenser design either utilize the turbine base or provide for such short connections in the exhaust line that when used in combination with motor-operated pumps, the installation as a whole offers little for criticism on the score of its bulk. The use of reinforced concrete in turbine foundations in place of solid masonry ought to offer a further means of economizing in space required by smaller auxiliaries, since the latter should be able without much trouble to be located in hollow spaces in the concrete. Auxiliary piping costs little when lengthened a few feet here and there, and it is better to provide the space for high-tension apparatus, busbars, oil switches and compartments than to waste it upon pumps of important function but great flexibility of location. With the motor-operation of generator field rheostats has come also a flexibility of arrangement of these bulky units never before enjoyed. Formerly rheostats of this character were suspended either from the under side of the switchboard gallery or attached to the ceiling of the already overheated basement. Now the designer may put them anywhere he desires, without regard to the old mechanical limitations or the cost and trouble of running numerous tap wires from the switchboard panel to the rheostat, and the typical case of locating this equipment on angle-irons fastened beneath the concrete arches between the pilasters supporting the craneway shows how easily the old conditions may be improved.

Wiring for both high-tension and switch-control circuits illustrates the trend of modern practice in the newer stations. Loose leads are practically tabooed, conduit and special fittings are firmly intrenched in both exposed and concealed construction, and all high-tension work is amply protected. The location of disconnecting switches within two or three feet of the floor against a wall behind the switchboard, with nothing in front to protect the operator from the bare contacts carrying many thousands of volts, may have been tolerated three or four years ago in certain cases, but it will not stand today. No feature of station design better deserves the consideration given it than the fireproof insulating switch and busbar cell now pretty well standardized. Again, penny-wise economies in the too meager installation of pilot lamps and extra switches controlling important units seem to have had their day. Too much money is tied up in modern units of large size—often a substantial fraction of a million dollars per machine—to warrant the cutting down of the appropriation by a few thousand when it comes to the selection of switching and measuring equipment.

Progress has also been making fast time in the boiler room and its management. Witness the character of station records now utilized in the best plants, the increasing use of analytical instruments, and the careful study being given the economical operation of pumps. These and many more welcome signs of the times are called forth and maintained by the enlarging responsibilities of the plants. Improved light and ventilation are also playing important parts in the boiler-room economy, and designers must reckon with the factor of personal comfort to a greater extent in the future, in its relation to efficient service. In all departments of station operation can be seen the good effects of broad designing, and there is little question that as a result expansion will in the main tend to increase the operating efficiency in the majority of lately constructed steam-electric generating plants.

DOING BIG BUSINESS ON A BUSINESS BASIS.

At the convention of the American Electric Railway Association at Atlantic City last week, no subject received more attention from the most prominent speakers nor aroused more interest and discussion than that which related to public policy and the effect of a proper understanding upon the part of the public of the efforts being made by the electric railway corporations to give efficient service at reasonable rates of fare.

The electric railway comes in contact with every element that goes to make up the population of a city or town. No matter how carefully the railway officials may work to provide schedules that will best serve the majority of its patrons, any particular element of the riding public finds any particular inconvenience to which it is subjected a specific reason for setting up an antagonistic spirit to the com-

pany. It is true that a great many of the conditions which the riding public look upon as inconveniences are absolutely necessary in order that the majority may be properly taken care of. Thus, shifts to cars ahead, transfers at apparently illogical points, infrequent service on some lines, are very seldom perpetrated upon the public because of a near-sighted or miserly policy on the part of the company, but because the equipment is urgently needed for some other contingency. That part of the public suffering, however, from that inconvenience, feels abused and there is no one to explain why the inconvenience to which it is subjected is pretty nearly a necessity.

Notwithstanding the efforts which many companies are really making toward giving effective service and keeping a little in advance of every reasonable demand, it is a fact that so often has the public been exasperated by what appears to have been needless inconvenience followed by inadequate explanation, that the public mind has become poisoned to a considerable degree, and a great many corporations find themselves in disfavor with city officials, not because of anything they have done themselves, but because of the general impression that prevails that the corporation is a monster and is not entitled to fair treatment.

For several years the American Electric Railway Association has gone on record endorsing many ideas which have had for their especial significance the suggestion of improving the relations of the electric railways with their patrons. This year the matter has been carried further and almost to a point of practical application. It is to be hoped that something more than discussion will come of these suggestions and that the ideas advanced by so many of the leading men in the electric-railway industry will bring about a very much better condition of affairs.

An interesting commentary on this situation occurs in connection with the financing of one of the biggest operating telephone companies. This company serves a great territory in a half a dozen states in the western part of this country. A very large number of its subscribers are stockholders —in fact, the company and its ramifications have been financed right out of the territory which they serve. Good service, clean financing, and wide-open publicity constitute the platform upon which Mr. E. B. Field, president of the Mountain States Telephone and Telegraph Company, has built up this splendid enterprise. His patrons and his stockholders believe in him and he believes in them. In a recent letter to the stockholders of the company Mr. Field set forth his policy. It is quoted here as an example which might well be followed by other corporations. This is a policy which, it seems, cannot lose. Here is what he says: "A last word. It shall be my policy in the future, as in the past, to keep your investment clean. So long as our stock finds a ready market by which the funds necessary to care for growth and improvements to the property may be readily provided, no bonds will be issued. There will be no preferred stock. There will be only the common stock unincumbered by fixed charges; common stock represented by a substantial margin of actual values over the liabilities; common stock earning, and entitled to earn, safe, honest dividends. Your property shall be free from any criticism that its methods are not scrupulously clean both as to its financial policy and as to its duty to the public."

SCHOOL FOR ELECTRIC-VEHICLE OPERATORS.

In his presidential address before the second annual convention of the Electric Vehicle Association of America, held recently in New York City, Mr. W. H. Blood, Jr., voiced a suggestion that is worthy of the most serious consideration on the part of those interested in the advancement of the electric-vehicle industry, and particularly on the part of central-station companies.

The substance of Mr. Blood's suggestion that we wish particularly to emphasize here is that in trade schools, and elsewhere, regular courses of lectures and exhibits which will familiarize the young men of the country with the simplicity and efficiency of the storage battery and motor as applied to electric vehicles, should be established.

This suggestion is of particular significance when it is realized that the vast majority of electric-vehicle trouble is due to unintelligent and careless handling, and it is generally conceded that much of the hesitancy on the part of the public to adopt the electrically propelled vehicle can be traced directly to influences that this condition has produced.

From the central station's standpoint the idea can be enlarged upon where local conditions warrant it. Central stations now realize that they must take the initiative in the introduction of electric vehicles locally. There is a difference of opinion regarding to what extent the central station should exploit any of the current-consuming devices upon which it depends for the development of its business, but with the electric vehicle, the central station must stand back of it and assume its share in the expense of its introduction, as the electric vehicle depends largely upon the supply company for its continuity of operation, and the company will continue to reap its reward long after the selling interests have cashed the checks tendered in payment of the machines.

With a full realization of this many of the progressive companies are spending thousands of dollars in educational campaigns, no small part of which goes towards maintaining an electric-vehicle department or bureau, comprising battery and vehicle experts whose duty it is to give assistance in case of trouble. It is here where the suggestion of Mr. Blood can be applied to advantage. The central-station company could maintain an electric-vehicle school where regular instruction could be given in the care of batteries and motors, and the handling of both batteries and vehicles. The scheme could be worked further and electric-truck users could be encouraged to require their operators to obtain certificates from such a school.

New Public Utility Laws in California.

By a special election held in California on October 10, for the purpose of voting upon twenty-three amendments to the state constitution, two new provisions respecting public utilities become operative. The jurisdiction of the State Railroad Commission is extended to include all public utilities, and an incorporated municipality is empowered to exercise full control over all such utilities within its domains. The new sections are as follows:

Every private corporation and every individual or association of individuals, owning, operating, managing or controlling any commercial railroad, interurban railroad, street railroad, canal, pipe line, plant, or any equipment relating to such, for the transportation of passengers or freight of any kind, or for the transmission of telephone or telegraph message, or for the production, generation, transmission or furnishing of heat, light, power or water, either directly or indirectly, to or for the public, and every common carrier, is declared to be a public utility, subject to such control and regulation by the railroad commission as may be provided by the legislature.

The railroad commission shall have and exercise such power and jurisdiction to supervise and regulate public utilities in the state, and to fix the rates to be charged for commodities furnished or services rendered. The right of the legislature to confer powers upon the railroad commission respecting public utilities is declared to be plenary, and to be unlimited by any provision of this constitution.

All powers respecting public utilities vested in boards of supervisors, or municipal councils, or other governing bodies of the several counties, cities and towns, or in any commission created by law and now existing, shall cease so far as such powers shall conflict with those so conferred upon the railroad commission; provided, however, that this section shall not affect such powers of control over any public utility vested in any city or county, or incorporated town as, at an election to be held pursuant to laws to be passed hereafter by the legislature, a majority of the qualified electors of such place shall vote to retain, and until such election such powers shall continue unimpaired; if the vote so taken shall not favor the continuation of such powers they shall thereafter vest in the railroad commission. It is further provided that where any such city or incorporated town shall have elected to continue any powers respecting public utilities, it may, by a majority vote, thereafter surrender such powers to the railroad commission; or if any municipal corporation shall have surrendered any powers to the railroad commission, it may, by like vote, thereafter reinvest itself with such power.

Any municipal corporation may establish and operate public works for supplying its inhabitants with light, water, power, heat, transportation, telephone service or other means of communication. Such works may be acquired by original construction or by the purchase of existing works, including their franchises, or both. Persons or corporations may establish and operate works for supplying inhabitants with such services, upon such conditions and under such regulations as the municipality may prescribe, on condition that the municipal government shall have the right to regulate the charges thereof. A municipal corporation may furnish such services to inhabitants outside its boundaries; provided that it shall not so furnish any service to the inhabitants of any other municipality owning or operating works of similar service to such inhabitants, without the consent of such other municipality, expressed by ordinance.

The State Railroad Commission is increased from three to five members, appointed by the Governor, instead of elective, as heretofore. The term is extended from four to six years, so arranged that two members relinquish office each two years. Provision is made for the removal of any member, for reasonable cause, by a two-thirds vote of the legislature.

The authority of the legislature in the matter of employers' liability is extended so that it may enforce all employers to compensate their employees for any injury incurred in the course of employment, irrespective of the fault of either party. For the settlement of any disputes which may arise it is provided that such be by arbitration, or by an industrial-accident board, by the courts, or by all of such agencies.

Canadian Wireless Agreement.

The Canadian Government has concluded an agreement with Marconi's Wireless Telegraph Company, London, the Marconi Wireless Telegraph Company of Canada, and the Marconi International Marine Communication Company, whereby the Marconi companies will forward all the wireless telegrams between the Atlantic coast of Canada and the British Islands at ten cents a word. The submarine Atlantic cables charge twenty-five cents. Press communications will be charged five cents only by the Marconi companies, and this last price applies also to weather news, notification of accidents and calls for assistance. At the same time the Marconi parties to the agreement take over the Government stations at Newfoundland, Quebec, New Scotland and New Brunswick. The agreement is for twenty years.

Telephone Society of New York.

At the meeting of the Telephone Society of New York to be held in the Engineering Societies Building, 25 West Thirty-ninth street, at 8:15 p. m., on Tuesday, October 24, F. H. Bethell will speak on "Conservation and the Wire Service."

Trans-Pacific Wireless.

It was reported on October 5 that wireless messages had been transmitted for the first time between San Francisco and Japan.

Railway Electrical Engineers' Convention.

The fourth annual convention of the Association of Railway Electrical Engineers will be held in Chicago, Ill., at the La Salle Hotel, November 7-10. The program has been announced as follows:

Tuesday, November 7, morning session: Address of president and report of secretary-treasurer. Afternoon session: Reports of Committees on Data and Information, and on Car Ventilation.

Wednesday, morning session: Reports of Committees on Standards, and on Improvements. Afternoon session: Report of Committee on Shop Practice; papers on "Insulation," by K. R. Sternberg, and on "The Light for Safety," by F. R. Fortune.

Thursday, morning session: Report of Committee on Specifications; paper on "The Gas-Electric Car." Afternoon session: Reports of Committees on Train-Lighting Practice, and on Illumination.

Friday, morning session: Reports of Committees on Accounts and Reports, and of Auditing Committee; election of officers. Afternoon session: Paper on "Industrial Trucks for Railway Service," by T. V. Buckwalter.

Entertainment features include a reception and dance, a theater party, an automobile tour, and the annual banquet and ball. The entire nineteenth floor of the La Salle Hotel will be used during the week. Space is provided for twenty-nine exhibits by manufacturers. Exhibits and entertainment are in charge of the Railway Electric Supply Manufacturers Association.

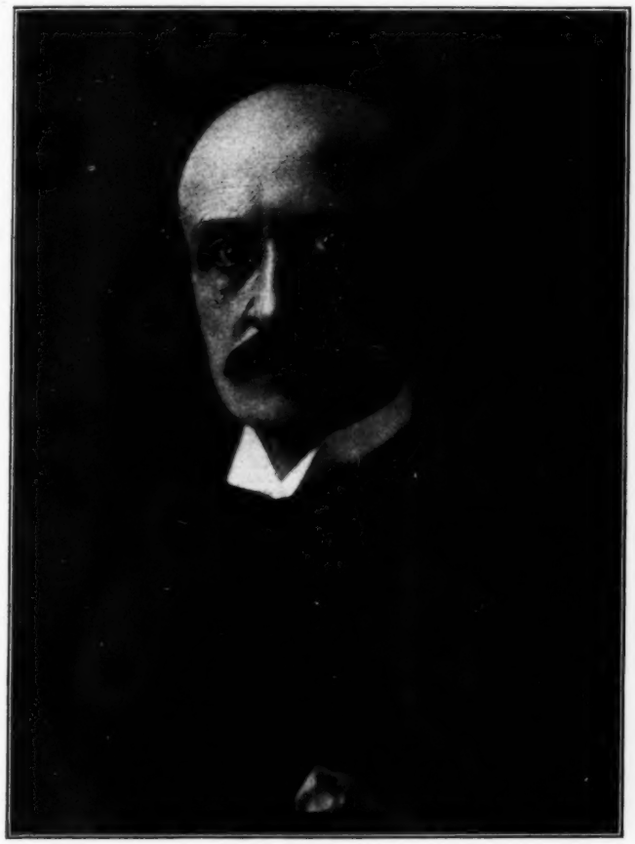
Dr. Steinmetz's Annual Chicago Lecture.

For many years it has been customary to inaugurate the season of monthly meetings of electrical engineers in Chicago with a lecture by Charles P. Steinmetz. This delightful custom will be continued this year. Dr. Steinmetz will take as his subject "Reactance in Alternating-Current Circuits." The meeting will be held at 8 p. m., Wednesday, October 25, in Fullerton Hall of the Art Institute. As usual it will be under the joint auspices of the Chicago Section, American Institute of Electrical Engineers, and the Electrical Section of the Western Society of Engineers.

E. B. Field.

The story of the business career of E. B. Field, president of the Mountain States Telephone and Telegraph Company, affords the student of human activities a chronicle that out-distances in pure human interest, and in romantic appeal to the imagination, the most wholesome and inspiring fiction of the finished idealist.

In 1879 Mr. Field was in the wholesale woolen business in Boston. He was twenty-nine years of age, with a wife and three small children, with his health greatly impaired and suffering from an acute attack of tubercular infection of his lungs. His physician advised him to try Colorado, and told him that although he might recover his health on the dry Western plains, just so surely as he returned to New England he would be subject again to the ravages of this disease. He burned his bridges behind him and decided to make Colorado his permanent home.



E. B. FIELD,
President of the Mountain States Telephone and Telegraph Company.

He landed in the city of Denver on November 10, 1879. The climate acted well-nigh miraculously with him, and by January, 1880, he was practically well. Casting about for an occupation he finally persuaded F. O. Vaille, who had personally started the telephone business in Denver, the system having been in operation some six or eight months, to give him a position as a telephone operator. On January 10, 1880, Mr. Field started operating at a switchboard that was made by Charles Williams in Boston, Mass. This board was a direct duplicate of the original telephone switchboard made for Thomas B. Doolittle, at Bridgeport, Conn. Mr. Field stayed as local operator for three months, when he was transferred to operate the toll line running from Denver to Golden, Georgetown, Central City and Idaho Springs, which, in connection with Denver, was the extent of the telephone system. In 1881 the Colorado Telephone Company was incorporated and during that year Mr. Field was made general superintendent of the company, Mr. Vaille becoming general manager and H. R. Wolcott, his brother-in-law, who had furnished the money for the starting of the telephone business in Colorado, was president. In February, 1884, Mr. Vaille resigned as general manager and Mr. Field was elected by the board of directors to take his place. At that time both Mr. Vaille and Mr. Wolcott practically sold out the bulk of their holding of stock in the Colorado Telephone Company and the business that Mr. Field took over had about $110,000 invested in it, about 800 subscribers, and possibly forty or fifty employees. Mr. Wolcott had other very large interests and paid literally no attention to the telephone business, so the whole job was up to Mr. Field. Three or four years later he was elected vice-president, as well as general manager, Mr. Wolcott staying as president at the earnest request of Mr. Field. Later Mr. Wolcott resigned and Mr. Field became president of the company.

In 1885 the Bell Telephone Company, of New Mexico, was sold out at sheriff's sale, and Mr. Field, at the request of Theodore N. Vail and O. E. Madden, who at that time were at the head of the American Bell Telephone Company, went to New Mexico and acquired the rights of the company operating in that territory and formed the Colorado Telephone and Telegraph Company, which was a part of the Colorado Telephone Company. About two years ago the merchants of El Paso, Texas, where there was telephone competition, became anxious for better telephone service connecting them with cities and towns in New Mexico, and also with the larger cities in eastern Arizona, like Bisbee, Douglas and Benson, and so it seemed best for the interests of the people in those sections and because the Colorado Telephone Company had been successful in meeting the telephone needs in Colorado and New Mexico, that it should take over into this system these towns, so the Tri-State Telephone and Telegraph Company was incorporated with most of the same officials as the Colorado Telephone Company, and long-distance copper wires constructed between El Paso and the towns of Silver City, Deming, etc., in New Mexico, and in all of the towns in eastern Arizona.

A few years ago at the request of Mr. Vail, Mr. Field became a member of the board of directors of the Rocky Mountain Bell Telephone Company with headquarters at Salt Lake City, Utah, and operating in Utah, Idaho, Montana and Wyoming. He commenced a study of the situation and the comprehensive telephone needs of these four states. As a result of this study the Mountain States Telephone and Telegraph Company has recently been organized and into this company has been merged the Colorado Telephone Company, the Tri-State Telephone and Telegraph Company, and the Rocky Mountain Bell Telephone Company. The Colorado Telephone and Telegraph Company, which had been formed years ago to operate in New Mexico, went out of existence a few years ago and was merged into the Colorado Telephone Company, so that the new Mountain States Telephone and Telegraph Com-

pany now operates in Colorado, New Mexico, eastern Arizona, Utah, Idaho, Montana and Wyoming, with an operating arrangement with the Tri-State Telephone Company which still operates in El Paso, Tex.

The secret of Mr. Field's success lies probably in his having convinced the people whom he serves that he is absolutely loyal to their best interests. His companies are financed among the people who are the most extensive users of these utilities. His investment is their investment and they are heart and soul with him in his great plans for the development of these enterprises. In addition, however, to thus winning and holding the confidence of his business associates and the people he serves, he has had a master ability in the training of men and tying them to him through the bonds not only of personal loyalty, but of admiration and respect for capable leadership.

Meeting of Empire State Association.

The seventh annual meeting of the Empire State Gas and Electric Association was held in the United Engineering Societies Building, New York City, on Friday, October 6. There were about fifty-five present.

In the absence of the president, M. J. Brayton, R. M. Searle, of Rochester, the first vice-president, presided.

During the morning session the routine business, including the reports from officers and committees, was taken up and disposed of.

The Committee on Arrangements suggested the following schedule of meetings and subjects:

November, Syracuse, Street Lighting; January, Buffalo, Railroad Crossings; February, Poughkeepsie, Accounting; March-April, Fulton, New Business; May, Ithaca, Joint Use of Poles and Suburban Distribution; June-July, Rochester, Use of Auto Trucks.

This program will be carried out during the coming year.

The report of the Taxation Committee brought out an interesting discussion on this subject. The chairman outlined a method of taxation and stated a number of arguments for it. He was requested to prepare his discussion of this subject in such form that it could be printed and distributed to the members.

After the reports had been received, Mr. Hutchings, of the Rochester Railway & Light Company, presented some interesting figures in regard to the new Stanley electric range and a very interesting discussion ensued which was taken part in both by the representatives of the electric companies and the representatives of the gas companies as well. Further discussion ensued after luncheon.

The operation of the range was explained and estimates were presented of the proper price which could be charged by the companies for its operation.

Mr. Searle had been requested to discuss the extent to which public-service corporations should enter into civic relations. His remarks were extemporaneous but the members were so much interested in his account of what was done in Rochester, that he was requested to put them in such shape that they could be printed and distributed.

The following officers were elected for the ensuing year, after which the meeting adjourned:

President, R. M. Searle; first vice-president, Charles G. M. Thomas; second vice-president, J. C. DeLong; treasurer, Stuart Wilder; secretary, C. H. B. Chapin.

Commission Control in Cleveland.

Leslie C. Smith, superintendent of the Department of Public Service, Cleveland, O., discussed the control of public utilities in a paper which was read before the League of American Municipalities Convention at Atlanta, Ga. Mr. Smith, in addition to giving his views on the matter of commission control, outlined the situation as found in Cleveland.

The Cleveland Water Works, he stated, enjoys the distinction of being the best constructed, most efficiently equipped and most economically operated utility owned by the people concerning which we have any knowledge. Since 1853 it has known no competition in the supply of water to the city's population.

Los Angeles Section A. I. E. E.

The season of the Los Angeles Section of the American Institute of Electrical Engineers was opened by an informal dinner on October 17. Following the dinner, Dr. James A. B. Scherer, president of Throop Polytechnic Institute, Pasadena, gave an address on "Technical Education from the Technical Standpoint."

Electricity at the Brewers' Exposition.

Probably no better indication of the importance of electricity and electrically operated machines in the various industries can be given than the extent to which electrical energy is utilized at the numerous expositions and trade shows of the various industries held almost continuously in the larger cities. A striking example of this is the Brewers' Exposition at present being held in the Coliseum, Chicago, Ill. It would seem, after an inspection of the comprehensive array of exhibits, that the brewing industry will have to rely almost entirely on electricity for the operation of the variety of machines which are at present being utilized in this business.

Of course in exhibits of this character the manufacturers of the machines desire to show their product in operation and electric motors therefore must be relied upon to furnish the motive power, as steam and internal-combustion engines are prohibited by the underwriters. The significant features of the majority of machines shown at the Brewers' Exposition, however, is the fact that electric motors are incorporated in the design of the machine and form an integral part of it, leaving no choice for the user as to the power he shall employ. This feature is particularly evident in grain scales; conveying machines for grain, bottles, cases and kegs; bottle washers; crowning machines; beer pumps; labeling machines, etc.

Several electrical manufacturers are also represented in the exhibits, this being a further indication of the importance of electricity to the brewing industry. The Allis-Chalmers Company showed several types of motors and transformers, the General Electric Company motors, beer-vat dryers, ozonizers, lamps, etc., H. W. Johns-Manville Company, pipe covering, roofing and asbestos material, the Charles L. Kiewert Company flaming-arc lamps, the General Vehicle Company a three-ton electric truck and photographs of trucks in the service of breweries, the Terry Steam Turbine Company showed a turbo-generator set, the Taber Pump Company a motor-driven pump and the Green Engineering Company automatic stokers. Motor-driven refrigerating plants were shown by the York Manufacturing Company, Kroeschell Brothers Ice Machine Company and the Fred W. Wolf Company.

Transforming Stations of Niagara Electrochemical Industries.—II.[1]

BY A. J. JONES.

NIAGARA ELECTRO-CHEMICAL COMPANY.

The transformer station of the Niagara Electro-Chemical Company is of interest in that it contains several different types of apparatus, each of which performs the same service, but in a slightly different manner.

The function of the station is to change the two-phase, 2,200-volt, twenty-five-cycle current received from the Niagara Falls Power Company into direct-current power. To perform this transformation the station is equipped with three different types of apparatus, namely, rotary converters with regulating transformers, induction motor-generator sets, and synchronous motor-generator sets.

The transformer station is a large roomy brick building situated on the east side of the cell room. The general scheme carried out in the station is that of locating the transformer units on the center line of the building with the switchboards along the walls. The receiving panels are located along the east wall and the unit panels along the west wall.

Power is delivered to the station by two two-phase, underground feeder systems, one of which connects to a receiving panel in the south end of the station and the other to a panel in the north end of the station. A third feeder enters the building and connects to both panels. This feeder is considered a spare feeder and is used only in times of trouble on one of the other feeders. The panel in the south end receives its power from No. 1 generating station over four cables with a cross section of 1,000,000 circular mils each. The north end panel is supplied from No. 2 generating station, the cables having a cross section of 1,250,000 circular mils.

Both of the receiving panels are of marble, and are equipped with eight knife switches, single throw, single pole, and two double-pole Westinghouse automatic circuit-breakers. From the receiving panels the power is carried to the unit panels through underground ducts in the floor of the station. The rotary converters in the south end of the station are equipped with starting motors and polyphase Stillwell regulators in the primary of the transformer circuits. The static transformers are of the oil-insulated, self-cooled type, both rotary converters and transformers being made by the Westinghouse Company. Each rotary is connected to a marble panel on both the low-tension and high-tension side. The induction motor-generator sets are of standard design made by the Westinghouse Company. Each set is connected to two marble panels mounted with the usual instruments and switches.

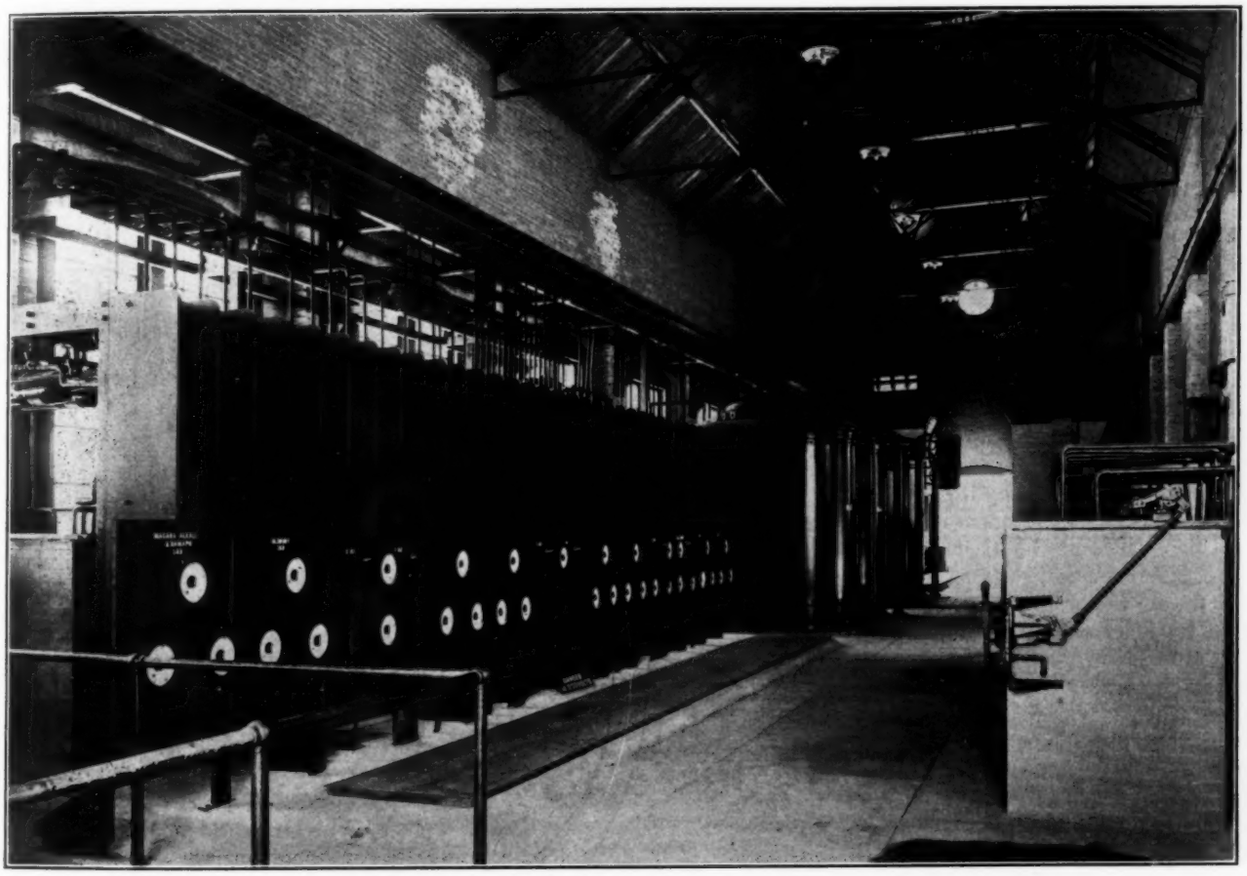


FIG. 8.—UNION STREET SUBSTATION OF THE NIAGARA FALLS POWER COMPANY.

1 Paper presented before recent meeting of the American Electrochemical Society in Toronto, Canada, slightly abridged.

The synchronous-motor-generator sets are made up of three units, two direct-current generators connected to opposite ends of a synchronous motor. Each machine is connected to a separate panel mounted with meters and circuit-breakers. The switchboard is of blue Vermont marble, designed and installed by the Westinghouse Electric & Manufacturing Company.

UNION CARBIDE COMPANY.

The plant of the Union Carbide Company at Niagara Falls, N. Y., is of interest both on account of its size and on account of the great amount of power transformed by it for electrochemical purposes.

Power is distributed to the Union Carbide Company by the Niagara Falls Power Company and by the Cliff Electrical Distributing Company, from substations located near the Carbide Works.

The Union Street substation of the Niagara Falls Power Company is located on the west side of the Carbide Company's No. 1 plant at a distance of about sixty feet. This station is used as a switching station and as a step-down station, being equipped with switchboard panels, oil circuit-breakers, and step-down transformers.

The substation of the Cliff Electrical Distributing Company is located midway between the No. 1 and No. 2 plants and contains switching apparatus only.

In the plants of the Carbide Company, widely separated from the substations, are the large low-voltage step-down transformers which supply power to furnaces. Some of the transformers have 2,200-volt primaries and others 11,000-volt primaries. They are all of the oil-insulated, water-cooled type, the cooling water being procured from the city mains.

Practically all of the 11,000-volt units have a double source of supply for their power. Bricked in the wall of the transformer bay is a marble slab mounted with a double-throw knife switch, the middle point of which is connected to the transformer, the jaws of one side being connected to the Niagara Falls Power Company's circuits and those on the other side to the Cliff Electrical Distributing Company's circuits.

The Union Street substation of the Niagara Falls Power Company has a capacity of 52,000 horsepower, made up of four 1,870-kilowatt, step-down transformers, two 11,000-volt switchboards, and one 2,000-volt switchboard, and supplies power to all of the plants in the immediate vicinity, including that of the Union Carbide Company. Power is delivered to the station by eleven three-conductor, paper-and-lead cables, and a three-phase, 500,000-circular mil aluminum overhead transmission line, both of which feed into a double busbar system through panels mounted with double-throw selector switches.

The switching apparatus which controls the Carbide units is of two kinds: 2,000-volt and 11,000-volt apparatus. The 11,000-volt units are fed from panels equipped with ammeters, switch-handles, and double-throw, single-pole knife switches mounted on electrose insulators. The brick cells containing two-pole, General Electric, oil switches are mounted back of the panels along the wall. Each unit is connected to the station by a duplex paper-and-lead cable laid in underground ducts.

The 2,000-volt units are fed from a switchboard on the east side of the station. Each unit is connected to a single-phase panel mounted with ammeters, oil circuit-breakers and selector switches.

The substation of the Cliff Electrical Distributing Company consists of a one-story brick building with basement. Power enters the station at a pressure of 12,000 volts over five three-conductor, paper-and-lead cables through ducts at the south end of basement.

Each cable terminates in a pothead, thence passes up to the main floor to knife switches mounted in compartments in the rear of Westinghouse automatic oil circuit-breakers. From the knife switches the circuits pass through the oil switches to knife switches and thence to busbars mounted on a maple framework. The outgoing cables are connected to the busbars through knife switches and non-automatic oil circuit-breakers.

CASTNER ELECTROLYTIC ALKALI COMPANY.

Power in the form of two-phase, 2,200-volt, twenty-five-cycle current is delivered to the Castner Electrolytic Alkali Company at three stations located in its Niagara Falls plants.

Transformer station No. 1 has a capacity of 1,375-kilowatts made up of eleven 125-kilowatt Westinghouse rotary converters, 500 revolutions per minute, two phase, twenty-five cycle, with Wagner step-down, air-blast transformers, each with a capacity of 100 kilowatts. These transformers have a secondary regulation of thirty volts, accomplished by means of a dial-switch regulator in the primary circuit. The transformers are single phase and are connected two in a bank to each rotary. The station is rectangular in shape with the rotary converters occupying the south side and the transformers the north side. The switchboard arrangements consist of single panels mounted opposite each unit between the transformers and rotary converters. The panels are made of white marble equipped with plug-type switches and fuse blocks. A dial switch with glass cover is mounted on the lower part of the panel.

In the east end of the station is located a receiving panel to which is connected eight single-conductor, lead-sheathed cables. The receiving panel is equipped with knife switches and carbon-break circuit-breakers. There are no low-tension switchboards in the station, the direct-current power being carried directly from the rotary converters to the cell room. In addition to the rotary converters the station contains four twenty-five-kilowatt, oil-insulated, self-cooled, Westinghouse transformers with 220-volt secondaries, which supply power to motors.

Transformer station No. 2 has a capacity of 4,000 kilowatts, consisting of eight 500-kilowatt Stanley synchronous-motor, direct-current generator sets, the motors being two phase, 2,200 volts and rated at 580 kilowatts. The sets are arranged four in a row on each side of the transformer room. On opposite sides of the room, between the wall and motor-generator sets, are two eight-panel marble switchboards, made by the Stanley Manufacturing Company. Each switchboard consists of four alternating-current panels and four direct-current panels, mounted side by side. The alternating-current panels are equipped with oil circuit-breakers, Stanley hot-wire ammeters and field ammeters. The direct-current panel is equipped with Weston ammeter, voltmeter, knife switches, and circuit-breakers. Supported on brackets in the rear of the switchboard are both alternating and direct-current busbars. Located in the northwest corner of the station is the main-line panel, equipped with eight knife switches and carbon-break circuit-breakers. The incoming cables, eight in number, have a cross section of

1,000,000 circular mils each and are capable of transmitting approximately 8,000 horsepower.

Motor power for the No. 2 station is obtained from six fifty-kilowatt Wagner transformers with 2,200-volt primary and 220-volt secondary. A seventy-five-kilowatt, oil-insulated, self-cooled Wagner transformer supplies power for lighting. These transformers are controlled from a panel equipped with oil circuit-breakers.

No. 3 station of the Castner Company is equipped with an 800-kilowatt General Electric, oil-insulated, water-cooled, transformer with 2,200-volt primary and 144-volt secondary. Connected in the secondary circuit is a potential regulator capable of varying the voltage from 85 to 225 volts. The regulator is oil-insulated, water-cooled, and of same make as the transformer. A single-phase slate switchboard is mounted in the station in front of the transformer. The switchboard is equipped with knife switches, oil circuit-breakers, indicating meters and watt-hour meters. The primary circuit is opened and closed through an oil switch, mounted on the wall above the transformer.

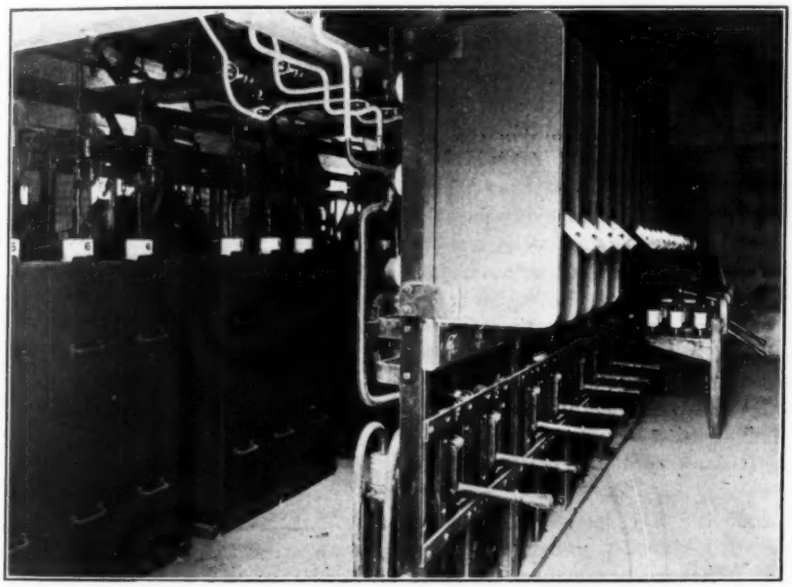


FIG. 9.—SUBSTATION OF CLIFF ELECTRICAL DISTRIBUTING COMPANY.

ELECTRO METALS COMPANY.

At Welland, Ontario, the Electro Metals Company has installed a modern transformer station which steps down the high-voltage current received from Niagara Falls to a low voltage suitable for furnace operation.

Power is received from Niagara Falls over two pole lines, each carrying two three-conductor transmission lines which are dead-ended at a switch platform located in the street outside of the Electro Metals Company's plant. From this structure the current is conducted into the plant over a single pole line carrying two three-conductor circuits which enter a brick switch room through porcelain tubes fastened in the wall and connect to knife switches mounted directly inside on the wall. From the knife switches the circuits are carried to busbars, thence through choke coils to a three-pole, 13,000-volt oil circuit-breaker.

Mounted on the east wall is a meter panel containing three ammeters, watt-hour meters, and a Westinghouse graphic wattmeter. On the floor to the left of the meter board is a concrete structure containing the potential transformers and fuses. Westinghouse electrolytic lightning arresters protect the incoming lines.

From the bottom of the oil switch the circuits pass along the west wall of the switch house to the main transformer room, where they connect to busbars supported on three concrete shelves built in the wall above the transformers. On a shelf on the west wall of the switch house are three twenty-five kilowatt Packard oil-insulated, self-cooled transformers with a ratio of 12,000 to 220 volts, which supply power to the motor circuits. These transformers are protected by a three-pole, oil circuit-breaker.

In the main transformer room are located seven 750-kilowatt units with 12,000-volt primaries and forty-volt secondaries, oil insulated, water cooled, manufactured by the Packard Company. They are arranged in a line along the wall which separates the transformer room from the furnace room. Each transformer is controlled by a two-pole automatic remote-control oil circuit-breaker in one leg of the circuit, the other leg being connected to the busbar through a knife switch. The circuit-breaker is mounted on a wooden framework alongside the transformer, and is controlled from the furnace room by iron connecting-rods. Knife switches are mounted above the transformers, arranged to connect the transformers to any one of the three busbars, thereby keeping the load balanced. Copper busbars connect the transformers to the furnaces, the load on the furnace being regulated by a Thury regulator, manufactured in Geneva, Switzerland. A 500-kilowatt Packard water-cooled transformer is used for experimental purposes.

THE NORTON COMPANY.

The electrical equipment of the Norton Company at its Niagara Falls, N. Y., works is typical of the equipment of several plants in the Niagara district. Power is received at a switch house, from which it is distributed to step-down transformers located in bays along the side of the furnace room.

In the switch house are located a marble receiving panel mounted with disconnecting switches, two double-pole, oil circuit-breakers, a motor and light panel equipped with knife switches and expulsion fuses, and a transformer panel. Adjacent to the switch house is a transformer bay containing a 1,500-kilowatt, oil-insulated, water-cooled, Wagner transformer with 2,200-4,400-volt primary and 110-220-volt secondary, with an oil switch mounted on the wall above the transformer. The panel for this transformer is located in the switch house.

Attached to the furnace room on the same side as the switch house are two bays containing 750-kilowatt units, together with control panels and water switches. Both units have a ratio of 2,200 to 110 volts, and are of the oil-insulated, water-cooled type. The bays are connected to the switch house by a pair of single-conductor, lead-sheathed cables with taps at each bay.

In the north end of the main build-

ing are located the lighting and motor transformers, consisting of two thirty-kilowatt and two ten-kilowatt, oil-insulated, self-cooled, Westinghouse transformers with 110 and 440-volt secondaries.

Power is supplied to the Norton Company from No. 2 generating station of the Niagara Falls Power Company by a two-phase, 2,200-volt feeder system, consisting of two 500,000-circular-mil and two 1,000,000-circular-mil lead-sheathed cables. The secondary current of the three furnace units is carried to the furnace room by copper busbars interlaced up to the furnaces. Each furnace is equipped with an indicating ammeter mounted on the wall opposite the furnace.

The Norton Company has recently completed a new plant at Chippawa, Ontario, for the manufacture of crystolon. In this plant a modern transformer station has been installed whose function is to transform the high-voltage power generated by the Ontario Power Company, at Niagara Falls, to a lower voltage suitable for furnace work and induction-motor operation.

The transformer station proper is divided into two sections, namely, a room for the transformers and a room for the main-line switches, lightning arresters, etc. The three-phase transmission lines carried on the same pole line terminate in the switch house and connect to knife switches, cross-connected on the lower side so as to parallel the lines whenever both sets of switches are closed. From the knife switches the current is conducted through choke coils to a three-pole, 300-ampere 13,000-volt oil circuit-breaker, mounted in a concrete cell on a gallery on opposite side of the switch house. This gallery is reached from the main floor by a spiral stairway.

On the ground floor and to the right of the knife switches are located four cells of aluminum lightning arresters with horn-type spark gaps, designed and manufactured by the Canadian General Electric Company.

The oil circuit-breaker mentioned above is unique in that the time-limit relays for tripping the switches are made to carry the full high-voltage current of the line instead of being energized from current transformers.

The relays are mounted on porcelain insulators directly below the gallery floor, with a tripping rod passing up through the floor to a toggle-joint on top of the switch. On the floor beneath the gallery in concrete cells are located potential transformers and fuses.

From the oil switch the circuits pass through a wall to busbars in the main transformer room. These busbars are constructed of insulated wire supported on brackets and insulators fastened to the wall adjoining the furnace room.

The main unit consists of a 750-kilowatt transformer with induction regulator in secondary circuit. The transformer has a ratio of 12,000 volts to 145 volts, the regulator having a range of seventy-five volts up or down, which gives a voltage variation on the busbars of 75 to 215 volts. Both transformers are of oil-insulated, water-cooled type, the transformer being built by the Canadian General Electric Company and the regulator by the General Electric Company.

The transformer is protected by a two-pole, 300-ampere automatic oil circuit-breaker mounted on an iron framework near the transformer. There are no walls or barriers between the switch points, which are placed about two feet apart. Knife switches connect the main unit to the busbars, and are arranged so that the transformer can be connected to either busbar. The 12,000-volt circuit is opened and closed through a water switch, whose main elements consist of two wooden barrels supported on porcelain petticoat insulators.

The motor load is provided for by three forty-kilowatt oil-insulated, self-cooled Packard transformers, with 12,000-volt primaries and 440-volt secondaries connected in delta. A three-pole, 300-ampere, automatic, oil circuit-breaker mounted on pipe framework controls these transformers. On a small panel in the furnace room are located the indicating meters of the main unit. The switch handles that operate the oil circuit-breakers are mounted on a small marble panel in front of the iron framework carrying the oil pots. The transformer room and main building are of concrete construction. The apparatus was installed by the Norton Company.

Price of Platinum.

The price of platinum continues to rise steadily. In Berlin, Germany, one of the centers of the platinum trade, it has recently been quoted at $650 per pound.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

264TH MEETING IN NEW YORK, OCTOBER 13.

The regular monthly meeting of the American Institute of Electrical Engineers was held in the Engineering Societies Building, New York City, on October 13. President Gano Dunn called the meeting to order and gave a brief account of the recent meeting of the International Electrotechnical Commission, which he had attended in Turin, and of the International Electrical Congress.

The paper of the evening was by B. G. Lamme and was entitled "A Theory of Commutation and its Application to Interpole Machines."

COMMUTATION AND INTERPOLES.

Mr. Lamme opens his paper with the statement that the usual analytical methods of working out commutation problems do not permit of a ready physical conception of what actually takes place. Moreover there is in a number of instances apparent contradiction of fact in the usual methods of attacking the problem. He therefore develops a method based upon a theory of commutation which states that the armature conductors in cutting across the magnetic field set up by the armature winding generate an electromotive force in the short-circuited coils which is proportional to the product of the revolutions, the flux that is cut, and the number of turns in series. There are three principal armature fluxes which are cut by the short-circuited armature coils. These are: (1) the slot flux which crosses from slot to slot; (2) the interpolar flux which passes from the armature surface to the neighboring poles or yoke surface; (3) the end flux set up in the armature end winding in the zone of the short-circuited coil due to the magnetomotive force of the end windings as a whole. The short-circuited armature coils cutting across these three fluxes generate the short-circuit electromotive forces. The whole problem, therefore, depends upon the predetermination of these three fluxes. Mr. Lamme does this by taking up the interpolar flux first, and showing how it is influenced by pitch end chord windings, and by width of brush. He then takes up the end fluxes and considers how they are similarly influenced. The slot flux is the most difficult one to calculate. He considers it first on the assumption that no local currents are present, then shows how it is influenced by chord winding. Bands on the armature core introduce another factor into the calculation. When the local currents are considered in their influence on the slot flux the calculation of the latter becomes rather complex. It has usually been considered that field distortion has a marked effect on these calculations. The author states, however, that in his opinion it has practically nothing to do with the problem. After developing the final formula which is a summation of the various fluxes, he considers its application to interpolar machines. Theoretically it is necessary to have exact equality between the interpole and the armature electromotive forces. In practice this is difficult to obtain. In fact, a slight excess in the interpole strength is frequently advantageous. The shape and proportions of the interpole face have a marked bearing on the effectiveness of the interpole, as does the brush setting. Saturation of the inter-

pole circuit is considered at some length, as its influence is very important on the interpole action. A short-circuit on an interpolar machine producing eight or ten times the full-load current will make such a machine even of ordinarily good design flash very badly, as the interpole is bound to be saturated at eight to ten times normal current. If there is combined with interpoles a set of compensating windings in the main poles, the interpole may be effective with rather heavier currents and the flashing load becomes much higher. In conclusion Mr. Lamme states that he has subjected his method to actual experiment on a very large number of direct-current machines of various types. In those cases where the test data of the machines were very accurately obtained the agreement between the tests and the calculated results was found to be close, in some instances even indicating errors or inaccuracies in the test results. In a number of early interpole machines in which considerable disagreement between the results of the calculations and of actual test was found, later experience showed definitely that the proper interpole field strength or proportions had not been obtained or that the proper brush setting had not been used.

The discussion was opened by Fred Urban, who thought the merit of Mr. Lamme's paper consisted of the method in which the matter had been handled rather than in any new ideas which had been brought out. With regard to the overload capacity of the machine on short-circuit, he stated that modern machines would not stand as bad a short-circuit as the older machines. He had found by means of oscillograph records that turbine-driven generators would carry loads up to seven or eight times normal without flashing over. When fitted with compensating windings the same machine would carry up to ten or twelve times normal load without flashing. Photographs taken at the moment of short-circuit indicate that the gas is thrown out ahead of the brush. This gas is of high conductivity and carries the arc. If half the brushes were taken off the commutator, the machine would flash over with about five times the normal load.

H. F. Hoxie criticised the manner in which Mr. Lamme had described what goes on in the machine. He did not consider that magnetic fluxes could be taken as made up of different components, each due to its own magnetomotive force, because if the fluxes due to these different forces alone were taken and added together it would not give the resultant flux, at least where magnetic material is in the circuit, and especially where some of the parts of the circuits are saturated. It is not correct to speak of an electromotive force generated solely by armature flux cutting a commutating coil unless the actual flux is meant. He considered that resultant magnetomotive forces should be considered in every case. He disagreed with Mr. Lamme regarding the statement that field distortion has nothing to do with the problem of commutation. He considered the problem of commutation to be, that during the time a coil is short-circuited there should be an electromotive force opposed to the current which was sufficient to stop that current and reverse it, bringing the new current up to the value that exists in the next coil. If this can be done an ideal commutation will result. He referred to the early work of Harris J. Ryan, who used a pole-face winding over twenty years ago which gave the same effect as the interpole winding of today.

H. M. Hobart spoke of the new point of view which Mr. Lamme brought up. The difficulties with reference to the armature flux are mostly in estimating the reluctance of the path followed by it. The reactance voltage can be well determined nowadays. The difficulty has arisen with the introduction of interpole machines and variable-speed motors having too great an average voltage between the commutating segments. The introduction of interpoles has tempted designers to increase the average voltage. This has come about through decreasing the number of segments with a view of cheapening the machine. Continuous-current generators should not be driven at high speed. There are many aspects of commutation that cannot be worked out theoretically, such as grooving out the mica between commutator segments, design of brush holders, material of the brushes, mechanical rigidity of the commutator, etc.

Malcolm MacLaren discussed the simplification of the formulas when applied to a single class of machines. Taking the four-pole machine, he showed the form which the equations take. Referring to Mr. Lamme's statement that a full-pitch winding commutates better than a chorded winding, he pointed out that the effect was not large when account is taken of the neutralization of the armature conductors in the chorded zone. The effect of chording upon the slot flux as given in the paper is much greater than experience with actual machines would indicate. He has applied Mr. Lamme's formula to a number of non-interpole machines differing widely in type and capacity, and has not found close agreement. These indicated that the slot proportions do not have a predominating influence upon commutation. He suggested that Mr. Lamme's method of analysis applies rather to interpole machines where the interpolar flux is neutralized and pitch windings are used rather than to non-interpole machines using chord windings.

C. A. Adams showed that Mr. Lamme's assumption that the induced voltage in the short-circuited coil is due wholly to a mechanical movement of the coil through a stationary flux is applicable where the number of slots and the segments under the brush is very large, but does not apply when the number of coils under the brush is small. He considered this the principal distinction between Mr. Lamme's method and the more common method and he preferred the older method. The interpole flux due to the armature magnetomotive forces is the only flux which is cut by the coil undergoing commutation, if the fringing is negligible. Hence, the length of the air gap does not affect commutation. He had proven this by tests where the air gap was changed from 0.02 to 0.13 inch. There are, however, other objections to the short air gap. Pulsation of reactance in the main magnetic circuit should be considered, especially with short air gaps. If the number of teeth under a pole varies, reluctance also varies, thus causing a pulsation of flux. Shortening the air gap will sometimes decrease the pulsation, but in other cases it may increase it. In most machines, the number of slots under a pole is small.

R. B. Treat presented a discussion of the paper in writing.

C. F. Scott called attention to the paper of Mr. Lamme nine years ago on single-phase motors, and pointed out that the same commutation problem which was involved there appears in direct-current machines.

James Burke discussed the question of fractional field. The use of the interpole has necessitated increasing the field, and generally it must approach a full field to get the best results. Even with such a paper as this it is only a man with a great deal of experience who can build a non-sparking machine. He discussed the effect of the thickness of mica insulation on commutation and the difficulties of getting mica that will

stand the wear. The paper takes up only one kind of interpole construction, and that is perhaps the most inefficient kind because it takes the largest number of ampere-turns for producing a correct condition of commutation. The total field losses are very often doubled by the introduction of interpoles. He had tried using a less number of interpoles than main poles with entire success.

R. L. Wilson emphasized some of the points brought out by Mr. Lamme's paper. By the aid of charts he pointed out the necessity of over-compensating interpole machines and of obtaining a uniform current distribution under the brush.

B. G. Lamme closed the discussion. He stated that it was not the intent of the paper to make the subject of commutation easy, as he thought that very thorough study and experience were necessary in order to master the subject. Many of the formulas used do not give complete and accurate information, but only show part of the problem. His experience agreed with that of Mr. Urban in regard to short-circuited machines. The statement that field distortion did not affect commutation applied only to a particular machine. He did not think an inexperienced designer could do much better with his formulas than with the old ones. The meeting then adjourned.

At the meeting of the Board of Directors in the afternoon, at which all but five of the directors were present, a request was presented from the Portland Section for a Pacific Coast meeting at Portland in 1912 and it was decided to hold such a meeting provided a suitable program was in the hands of the Meetings and Papers Committee before March 1. It was reported that eighty-six associates had been elected to membership, forty-four students enrolled, and seven associates transferred to the grade of member. University branches were authorized at Yale University and Oklahoma Agricultural and Mechanical College.

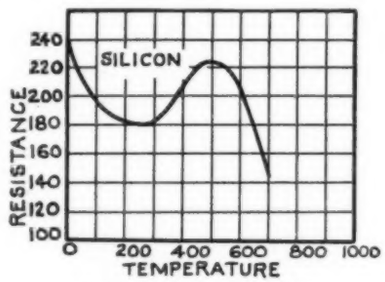
The president announced the appointment of W. D. Weaver to serve on the Edison Medal Committee and the following to serve on the United States National Committee of the International Electrotechnical Commission: C. O. Mailloux, president; Arthur E. Kennelly, secretary; Comfort A. Adams, Louis Bell, John J. Carty, Carl Hering, John W. Howell, John W. Lieb, Jr., Ralph D. Mershon, Edward B. Rosa, Charles F. Scott, Clayton H. Sharp, Samuel Sheldon, Charles P. Steinmetz and Samuel W. Stratton.

The report of A. E. Kennelly for the delegation to the International Electrical Congress at Turin was presented and the secretary was instructed to publish with the Standardization Rules of the Institute, the decisions of the International Commission in regard to symbology, phase relation in diagrams and the principles of rating machinery.

A Committee on Electrophysics was added to the standing committees of the Institute.

Variation of Resistance of Silicon with Temperature.

The resistance of most metals when heated increases gradually up to the melting point and then they experience a sudden increase to a still higher value. The resistance of silicon on the other hand shows an entirely different behavior when this element is heated. Some experimental results which have been obtained by A. A. Somerville and published in the *Physical Review* are shown in the accompanying diagram. Beginning with a temperature zero the resistance gradually decreases until a temperature of about 250 degrees centigrade is reached, above which point the resistance increases up to 500 degrees, where the resistance has about the same value as at ordinary temperatures. At still higher temperatures the resistance suffers a rapid decrease.



RESISTANCE OF SILICON.

The experiments were made upon a rod of silicon about 2.5 millimeters in diameter and several centimeters long. Connections were made by looping wires around the end of the rod and drawing them taut. Copper plating could not be made to hold the lead wires on account of the unequal expansion of copper and silicon. Similar results were obtained with several rods showing that the behavior was not due to any unusual conditions in the specimen.

Philadelphia Electric Company Section.

The active work of this section of the National Electric Light Association for the season 1911-1912 was inaugurated on September 25, with the meeting of the Commercial Department Branch. R. L. Lloyd read a paper on "Refrigeration from the Commercial Standpoint."

On October 5, the Accounting Department Branch held a well attended meeting at which a paper on "The Accounting System of the Philadelphia Electric Company" was presented by Frank A. Birch. The Meter Department Branch held a meeting on October 6, when a paper on Fort Wayne and Westinghouse Meters was presented by W. H. Donley. The formation of an Engineering Department Branch is anticipated, with others to follow.

The October meeting of the Section was held on October 13. This was the coming together, in general session, of all branches, as well as members not yet identified with any departmental branch, and was a most enjoyable occasion. The Membership Committee reported a total membership of 533, this being a gain of twenty-three over last report. R. A. Huebner was awarded a prize of five dollars for having secured the largest number of members during the quarter just ended. These prizes will be awarded quarterly.

Chairman Sproule made the announcement that Past-President William C. L. Eglin had donated a handsome gold watch to be awarded as a prize for the best paper presented at any departmental branch meeting of the section by a Class "B" member of the association.

John F. Gilchrist, president of the National Electric Light Association, was presented as the first speaker, and his talk was of high inspirational character, dealing with the phenomenal growth of the Association due to the fact that members have had their heart in the work, impressing upon all members their responsibility to the public, whose servants they are as employees of public-service corporations, urging broad fair dealing as the way to make the public think well of the companies. Loyalty to the corporation was urged, the advantage of being "a cog in the wheel" of a live corporation being far more desirable than being "a cog in the wheel" of an inactive individual ownership. Loyalty to the corporation

tends to develop character of higher order—bringing us closer to the 100-per-cent efficiency that we are striving for. Mr. Gilchrist justly contends that the profits of a corporation are most equally shared with those who bring success than is the case with individual ownership.

The second speaker was R. S. Orr, of Pittsburgh, president of the Pennsylvania Electric Association. He took as his topic "The Work of the Pennsylvania Electric Association." Mr. Orr contends that the work is intermediate to that of the Company Section and the work of the National Association, that the sphere is not along the line either of constructive or obstructive legislation, but rather that of getting the public mind to feel that the various companies in the State are aiming to give the best service and at the most reasonable cost, consistent with that service.

Other speakers were William C. L. Eglin and A. R. Granger.

Phenomena of the Discharge.

In the annals of the Brussels Society de Muynck describes some curious phenomena in connection with electrical discharge. He stretched a platinum wire over insulated supports 55 centimeters apart. The end of the wire was brought up to the spark-ball of a battery of four jars, charged from a Holtz machine. The wire could be heated by electric currents from another source. When the spark-gap was too great for a spark to pass, and the wire was hot, the wire gave out a musical note, and was observed to be subjected to oscillations of considerable amplitude—about one centimeter; the sound was not clear, however, and the pitch would vary with temperature changes in the wire and also for some other reasons not understood. The cold wire did not oscillate. De Muynck suggests that the wire is attracted by the sphere, moves towards it, and is cooled by the partial discharge and the loss of electricity accompanying it; the wire then recedes, and it is attracted again, and thus oscillations are set up.

Losses from Fire.

The total losses from fire, in the United States and in Canada, during the first eight months of 1911 were $167,655,550. At this rate, the total for the year will be in excess of $250,000,000.

CENTRAL-STATION BUSINESS IN THE SUBURBS OF CHICAGO.

ADDRESS BEFORE CHICAGO ELECTRIC CLUB.

In an interesting address delivered before the Chicago Electric Club on October 18, John G. Learned, general contract agent of the North Shore Electric Company, explained the character and extent of the business carried on by this company in the outlying districts of Chicago.

The North Shore Company serves seventy-two municipalities located in a territory covering 120 square miles. Mr. Learned exhibited a map showing the location of these towns, the network of transmission lines maintained by the Company and the location of its generating and substations. Twenty-four-hour service is provided all customers.

Mr. Learned explained the difference in the business obtained in various localities, certain portions of the southern territory providing a power load almost exclusively which in certain sections of the northern and western territory the business is practically all lighting. Energy for both light and power is taken from the same lines, this necessitating the company insisting upon strict motor requirements. For the good of the service all motors above thirty-five-horsepower size must be of the slip-ring type.

The contract department of the North Shore Electric Company comprises thirty solicitors who devote their entire time to securing new business. The company maintains and furnishes energy for street lighting in fifty-two of its towns and operates the waterworks and pumping stations for fourteen municipalities. Other business of an important character which the company controls is the furnishing of energy to the Chicago & Milwaukee Electric Railway, the Gary Interurban Railway and the Chicago Southern Traction Company.

Regarding domestic business Mr. Learned said that of the company's 30,000 customers, one in every five have electric irons. In the Fox Lake district considerable cooking business has been obtained by introducing an electric fireless cooker but this device has not been entirely satisfactory. Encouraging progress has also been made in securing farmers' business along the company's lines. Mr. Learned said that the co-operation of the manufacturers has been of great assistance in increasing the residence business. The North Shore Company maintains sixteen display rooms and advertises in thirty-six newspapers.

Frank F. Fowle opened the discussion asking if the company did not obtain considerable business from farmers along the line of the Chicago Southern Traction Company to Kankakee. Mr. Learned said that the company delivered the current to the railway substation at the beginning of the line but the traction company obtained permission to sell to farmers along its lines.

In reply to several questions asked by Mr. Connelly, Mr. Learned said that all energy supplied by the North Shore Company is alternating current some single phase but the majority three phase. Single-phase motors over five-horsepower size must be provided with a non-inductive starter and three-phase motors over thirty-five horsepower must be of the slip-ring type. With all three-phase motor installations a no-voltage release switch must be installed.

Regarding lamp renewals Mr. Learned said, in regard to a question, that carbon lamps were renewed free the company delivering these on specified days in towns where renewal stations are provided. Elsewhere the customer must call for renewals. An allowance of twenty cents is made on all special lamps desired when carbon lamps are returned. The company is considering installing Gem lamps as the initial installation.

President Neisz spoke briefly in regard to the manufacturers, jobbers and contractors co-operating with central stations in the sale of electrical appliances and then announced that the resignation of A. A. Gray, vice-president of the club, had been accepted with regret. Frank F. Fowle was elected to fill the unexpired term. This office carries with it the chairmanship of the Speakers' Committee.

Alabama's Coal Production.

Alabama's coal production in 1910 was 16,091,979 short tons, valued at $20,209,577, a large increase over the figures for the preceding year.

Power from the Danube.

The water power of the Danube is to be utilized between Vienna and Budapest. Seventy thousand horsepower will be obtained.

The Denver Electrical Show.

Second Annual Show of the Colorado Electric Club, Held in the Denver Auditorium, October 14-21.

The second annual electrical show of the Colorado Electric Club opened in the Denver Auditorium on Saturday evening, October 14, continuing through the week to October 21. All the exhibitors' spaces were sold weeks previously to the opening of the exposition and everything seems to indicate a financial success for the second undertaking of the Colorado electrical interests of which the Colorado Electric Club's membership is composed.

The opening ceremony, commencing with the firing of bombs from the roof of the Denver Gas & Electric Light Company's building, was a magnificent street parade. It was easily the most spectacular procession seen in Denver since the days of the Mountain and Plain Festivals and the pageants of the Slaves of the Silver Serpent. The procession was confined exclusively to the exposition of electrically propelled vehicles, both pleasure cars and commercial trucks participating.

The illuminated parade was an innovation in Denver, and along with being the most spectacular ever witnessed in Colorado it was also the most beautiful. It surpassed in splendor and brilliance the illuminated street parade which electrified and surprised the visitors at the Centennial Exposition held at Colorado Springs a few months ago and which was considered to be the most gorgeous display of electrically lighted vehicles ever seen in Colorado or elsewhere.

There were between 100 and 150 pleasure cars and commmercial vehicles in line, representing a valuation of about $350,000. Those in the parade, however, represented only about a third of the electric vehicles in Denver. Denver claims the distinction of having more electrically propelled pleasure vehicles than any other city in the United States in proportion to her size. Heading the procession was a platoon of police in open cars. The police escort was conspicuous, due to the absence of the familiar horse, this being the first parade ever held in Denver in which the police conveyances were electrical vehicles. Following this section were the decorated cars, the first in line being the coupes, next the open cars, and last the display of electric commercial vehicles. Practically every car entered in the procession was lavishly decorated in light and flowers, and it is estimated that somewhere in the neighborhood of $1,500 was expended by the ladies participating. Vari-colored miniature electric lamps, festoons of artificial and real roses, huge banks of natural chrysanthemums, were some of the materials used in the decorations on the different cars. Others with flags portrayed in light, on either side; one car with a child sitting on the front seat holding a miniature electrically lighted lamp, while another, decorated in white roses, had a snowy-white poodle dog sitting on the front seat, proud and erect, as if he understood the importance of the occasion, and still another, decorated in white, with an illuminated star representing the North Star, formed striking spectacles which won the admiration of the street crowds.

Yellow, red and white, with electrical effects to match, were the color schemes adopted by the ladies contesting. The cars were inhabited mostly by Denver's social set, all beautifully gowned in keeping with the richnesses of their conveyances. A peculiar feature of the parade was that practically every prize was won by the feminine contestants.

The Sons of Jove were also well represented in the parade, all dressed in the familiar "Red Devil" costume of the order. The Jovian representation was in the commercial electric vehicle section, which was profusely lighted in red, the color of the organization. The awards for the best-decorated cars were as follows. Coupe class—first prize, Mrs. Charles A. Murnan, one pair of Diamond special electric casings; second prize, Miss Martha Fisher, fifty dollars in gold; third prize, Mrs. Anna M. Scott, twenty dollars in gold; fourth prize, Mrs. Sol Mayer, set of slip covers; fifth prize, Mrs. M. Kleiner, silver-mounted vase; sixth prize, Miss Blanche Edison, one pair of Goodrich inner tubes; seventh prize, Mrs. D. B. Simon, one automobile handbag; eighth prize, Mrs. Richard Parker, electric headlight. Open car class—first prize, Mrs. W. P. Carstarphen, Jr., pair Goodrich-Palmer-Webb special electric casings; second prize, Louise Jones, fifty dollars in gold; third prize, Mrs. H. P. Simmons, twenty dollars in gold; fourth prize, Harry Hunsaker, set slip covers; fifth prize, Miss Archer, automobile robe; sixth prize, Mrs. C. A. Shaw, keyless auto clock; seventh prize, A. L. Englebaugh, one pair of Diamond inner tubes; eighth prize, Mrs. Newton Hilcoten, electric headlight.

The parade of electric vehicles was a fitting prelude to the electric show and proved an invaluable advertising medium to the show and the electric vehicle agencies in Denver. An electric searchlight situated in the Daniels & Fishers tower followed the parade to its termination at the Auditorium and added materially to the displaying of the decorated cars while judgment was being passed on them.

The attendance on the opening night of the show was even larger than last year and the confusion which marked the initial opening of the 1910 exposition was entirely absent. It is estimated that about 5,000 people were on hand to witness the second opening of the exposition. The street crowd out to witness the parade totaled about ten times that number.

The street illumination, although not as lavish as last year, was of a variety unseen in Denver before. Champa Street, the thoroughfare leading to the Auditorium, was decorated with the portiere effects, while Seventh Street, from the Welcome Arch at the Union Depot to the Brown Palace Hotel, was lighted with stringers suspended from the ornamental street lighting poles. On Seventeenth and Curtis streets, suspended about fifty feet above the surface of the street, was the emblem of the Sons of Jove depicted in light. This creation was partly destroyed by a violent windstorm during Saturday night, which necessitated its removal.

On the interior of the Auditorium the illumination was much the same as last year. The entertainment features, however, were of a vastly different type and are calculated to be of a much greater entertainment value than those heretofore used. The Electrical Ballet, produced for the first time in Denver and performed by Miss Ethel Hazel Wallick and company, was a feature greatly appreciated by the audiences. It is the opinion of the amusement committee that this feature was one that attracted a great deal of attention to the show. The electrical effects used in the production of the dances were some of the most magnificent ever seen outside of a theater. The stage on which the dance is performed is situated in the balcony at the extreme east end of the hall. The floor is of three-inch clear glass, through which myriad colors of electrical rays were filtered. At the western extremity of the amphitheater stereopticon slides were used to throw various colors on the effect. The dances were performed at all sessions of the show.

The exhibitors' displays showed more preparation and a much wider scope than was exhibited last year. Much attention was paid to the exploitation of electrical pumping apparatus, which is proving a means of putting considerable arid land in Colo-

rado under cultivation. Also the improvement in the displays of electrically operated mining machinery was noticeable. Within the last year the large power companies of the state have extended their power lines into districts within easy access of the dry farmer and mining operator, handicapped through prices to secure a reliable power for operation purposes. The exhibitors handling this class of machinery have evidently come to realize the importance of adequately displaying it at such an important exposition. These displays were all characterized by exhibits showing the actual operation of pumping and mining equipment.

At the luncheon of the Colorado Electric Club on the Thursday prior to the opening of the show an appropriation for the building and operation of an electric score board at the show was made. This was done so that the afternoon patrons at the exposition would have an opportunity of seeing every play in the world's championship series between New York and Philadelphia. This proved one of the big features and was successful in drawing a large number of baseball fans to the show who would have otherwise absented themselves.

In the basement of the show hall were the displays of the amateur wireless operators of Denver. There were about twenty-five of these exhibits, which attracted a great deal of attention at every performanee. Some of the exhibits of these young geniuses can hardly be differentiated from the finished product of the professional manufacturer. Other exhibits in the basement were the singing arc, the frying of eggs on a cake of ice, and other freaks of like nature. The experiments of the State School of Mines, of Golden, Colo., was also situated in this part of the exposition hall and was in charge of Prof. W. J. Hazard, consisting of lighting a lamp submerged in water without wire connection, the welding of wires with electrical current and the spinning of a ball on a porcelain dish and many other features of this kind. The freaks of high-frequency current, which proved one of the big features at the last exposition, were repeated on a much larger scale. These experiments were under the direction of Prof. Hylom T. Plumb, of Purdue University. A large room in the basement with a seating capacity of about 600 people was set aside for the production of these experiments. Professor Plumb gave a very interesting and instructive lecture on high-frequency current and explained the reason for death from the electric shock. He exploited also the secret of taking thousands of volts of electricity through the body. His demonstration consisted of showing the extent to which electro-magnetic waves will travel and form a contact which carries enough electricity to melt a heavy steel wire, light lamps and other weird features. In the most part, and in order to allay any impression of faking, his experiments were conducted with the help of his audiences.

One of the features was the lighting of ten lamps held in the hands of a number of spectators, who in turn join hands, forming a human live wire, as Professor Plumb chooses to call the experiment. Another feature which was a source of mystery and astonishment to the public was the lighting of a string of fifteen lamps with the aid of high-frequency current. The ignition of a quantity of gasoline with the finger tips, the lighting of paper and wood in the same manner and the melting of wire held in the hand were all features appealing to the visitors to the Chamber of Wonders.

The annual Rejuvenation of the Sons of Jove was also held during the week of the electric show. Between 500 and 600 Sons of Jove from all sections of the United States were in attendance and helped materially, by their numerous features, to make the electrical show a success. On Tuesday evening following the opening of the electric exposition a monster street parade of marching Jovians was held. This was surpassed in beauty and brilliancy only by the pageant of electric automobiles on opening night. Illuminated electrically propelled vehicles also played an important part in the Jovian parade. The following evening about 100 candidates were initiated into the order. After this ceremony a banquet was held at the Brown Palace Hotel, the Denver headquarters of the Sons of Jove.

The following manufacturers, with exhibits and representatives, were in attendance:

Allis-Chalmers Company, Milwaukee. Portable type air-compressor, induction motors, release starter, direct-current motor with starting box, engineers' valve. F. B. Fanger.

American Steel & Wire Company, Denver. Bare and insulated copper wires and cables of all kinds, rail bonds, springs and wire rope. E. R. Foot.

Babcock & Wilcox Company, New York. Boilers, drum heads and fittings, wrought steel sectional headers and fittings and a series of photographs showing Babcock & Wilcox boilers, equipped with superheaters and the firm's chain grate stokers. Wm. J. Rielly, Henry Byers.

Capital Hill Garage Company, Denver. Gould storage battery. Chas. A. Scott, Chas. M. Berkey.

Central Colorado Power Company maintained a reception parlor.

Colorado Electrical Specialties Company, Denver. "Hughes" electric ranges and hot plates, "Sykes" fireless cooker. R. F. Smith.

Denver Gas & Electric Light Company maintained a reception room on the center isle of the exhibitors' spaces. This booth was easily the most beautiful at the show. The roof was dome shaped and constructed of art glass through which electric light reflected. The company distributed a very elaborate souvenir of their new building. R. G. Gentry, assistant commercial manager, represented the company.

Denver Rock Drill and Machinery Company, Denver, Colo., represented the firm of Henry R. Worthington, New York City, and displayed several Deane single-acting, vertical triplex pumps, Clayston duplex, two-stage, belt-driven air compressors, Worthington centrifugal pumps and Deane power well-heads, Waugh stoping and sinking rock drills were also shown. C. L. Newcomb, Jr., Denver sales manager.

Electric Motor Equipment Company, Denver. Buffalo stationary vacuum cleaner, Thor electric home laundry machine, and the Simplex ironing machine. E. R. Harris, Frederick Nichol.

Electric Storage Battery Company, Philadelphia, Pa. Various types of storage batteries; the "Exide" battery, the "Chloride accumulator" and the "Tudor accumulator," featuring the "Ironclad-Exide" battery for electric automobile service and also a low-voltage isolated plant for farms and country homes not near a central station. Geo. D. Luther, E. J. Weinheimer, C. J. Hawkes.

Ellis National Electric Sign Company, Denver. Different sized electric sign letters from eighteen inches to five feet. J. W. Ellis, A. P. Thompson.

J. Fisher, a Denver electrical wiring contractor, maintained a booth arranged for a reception room with chairs and table on which were current magazines and all the Denver papers. The only exhibition was a board three feet by eight feet with three panels outlined with National metal moulding and fifty-four four-candlepower red lamps.

General Electric Company, Schenectady, N. Y. Full line of electric cooking and heating devices, including the new type range with broiling attachment, sewing machine, both alternating and direct-current breast drills, theatre lighting equipment for spot light and moving pictures, three kilowatt motor-generator set, induction motor, mercury arc rectifier, gas engine set, buffing and grinding motors, industrial motors of all kinds, complete line of electric flat irons, watthour meters, a portable wattmeter set, also curve drawing instruments, new type flame arc lamps, Mazda lighting equipment. W. W. Torrence.

Jackson & Wood Company, Denver. Models displaying the latest improvements in electric lighting for automobiles. R. B. Jackson, O. E. Wood, L. M. Wood.

Krebs-Gotshall Motor Car Company, Denver. Detroit electric trucks of 1,000 and 3,000 pound capacity. These cars were equipped with standard Edison storage batteries. There was also exhibited by this firm a 1910 model Detroit gentleman's roadster. A. S. Krebs, N. S. Gotshall, Ross C. Brown, Edward S. Crawford, N. G. Winbush.

Mine & Smelter Supply Company, Denver. Represented Fostoria Incandescent Lamp Company and H. W. Johns-Manville Company. Fostoria Mazda, Tantalum and carbon lamps. Johns-Manville Noark fuses, subway tubes, insulating materials and other specialties. The Mine & Smelter Company's exhibit consisted of a line of Wagner polyphase and single-phase motors, also a demonstrating unity-power-factor motor, making comparison between the standard and single phase and the unity-power-factor motors. T. Evans, R. S. Rubicam, Henry Eggers, T. S. Rattle, Geo. A. Saylor, A. H. Frederickson, A. D. Cross.

Mountain Electric Company, Denver. Century single-phase motors, Adams-Bagnall regenerative flame arc lamps, Bryan-Marsh drawn-wire Mazda lamps, and a full line of heating appliances of the Pacific Electric Heating Company make. John J. Cooper, J. W. Stearns, J. E. Johnston, L. L. Cooper, D. A. Wells.

Mountain States Telephone and Telegraph Company, Denver. Eighty-line lamp switchboard, fully equipped, mounted on revolving platform. This switchboard was in active operation during the show and the exhibitors were given free service to and from the city in his booth, the calls being handled through this board.

National Electric Lamp Association, Cleveland. "Holophane tree," a large tree-shaped fixture finished in statuary bronze on which were shown Mazda and Holophane units of six different sizes, the whole being surmounted by a 500-watt lamp. The circuits were controlled by a flasher which lighted the different tiers of lamps successively. A great variety of miniature and low-voltage lamps with drawn-wire filaments were shown lighted in a glass case, while lamps designed for automobile use were displayed in modern headlights, side lights, etc. A full line of multiple lamps was on exhibition in a case lighted w.th Mazda five-watt sign lamps. The floral decorations of the booth were supplemented by decorative lamps in the shapes of flowers, fruits, animals, etc. Ralph Beman and F. J. Blaschke were in charge.

Northwestern Supply Company, Denver. Tripartite steel poles, Franklin Steel Company, Franklin, Pa.; porcelain insulators, Pittsburgh High Voltage Insulator Company, Derry, Pa.; overhead material for trolleys, A. & J. M. Anderson Manufacturing Company, Boston, Mass. H. J. Barker.

Onderdonk Engineering Company, Denver. Sturtevant vacuum cleaner, Sturtevant ventilating sets; Lagonda boiler tube cleaner, Lagonda reseating machines; Keasbey & Mattison asbestos goods; Foster Engineering Company steam specialties; Blackburn-Smith feed-water filter and grease extractor; "Sarco" steam traps; "Firma" water-gauge glasses. Charles S. Onderdonk, Jr., E. W. Rich.

Sechrist Manufacturing Company, Denver. Art glass fixtures, showing Colonial, Crystal and Re-inforced Galvano styles and fixtures finished in silver. Bert Wasley, sales manager.

D. Vance Sickman, Denver. Represented the Crocker-Wheeler Company, of Ampere, N. J., the Pelouze Electric Heater Company, Chicago, Ill., and the National X-Ray Reflector Company, Chicago. The exhibit of the Crocker-Wheeler Company consisted of Remek transformers, type "Q" induction motors, form "L" and "I" motors. Also a number of large photographs showing turbo-type generators, both alternating and direct current. The Pelouze Electric Heater Company exhibited a complete line of electric heating appliances, consisting of coffee percolators, chafing dishes, toasters, water heaters, curling-iron heaters, and the Pelouze "Universal" iron. The National X-Ray Reflector Company showed a number of indirect fixtures of special design, also other appliances pertaining to the indirect system of illumination developed by this company. Exhibit in charge of D. Vance Sickman.

Vacuum Cleaner Sales Company, Denver. Santo vacuum cleaner, manufactured by the Keller Company, Philadelphia; Quam vacuum cleaner, made by the Quam Pneumatic Cleaner Company, Milwaukee; Ozone Pure Airfier Company, Chicago; Hamilton & Beach Vibrator made by the Hamilton & Beach Manufacturing Company, Racine, Wis.

W. C. Hendrie Rubber Company, Denver. Shoshone waterproof leather belting running in water and "Lanco" Balate belt running in oil. George W. Rogers.

Western Union Telegraph Company. Complete branch office equipment. Miss Sophie Willis.

Western Electric Company, Denver. Jewel washing machines, American electric irons, Sturtevant vacuum cleaners and the Western Electric sewing-machine motors; Holophane shades, the Sunbeam incandescent lamps and Hawthorn "Mazdaliers," and the new Western Electric apartment house inter-phone system. H. C. Biglin, S. E. Sanderson, H. W. Dye, C. Youngster, L. E. Moffatt, A. E. Bacon, E. M. Sexton.

Western Engineering Specialties Company, Denver. Duntley vacuum cleaners, Premier vacuum cleaners. "Bee" vacuum cleaners, Vulcan soldering irons and branding tools, Federal electric signs and clusters. L. E. Brown, A. O. Potts were in attendance.

LUNCHEON OF ELECTRIC VEHICLE CLUB OF BOSTON.

Electric Vehicle Club of Boston.

The Electric Vehicle Club of Boston held a meeting on October 4, in the Edison Building, with Herbert W. Moses in the chair. L. D. Gibbs, secretary, explained the plans of the Boston Edison Company for a flashing electric-vehicle sign. It was decided to invite the Electric Vehicle Association of America to hold the next annual convention in Boston. Other matters were discussed and a flashlight photograph taken, which is reproduced herewith.

The Electric Vehicle Club was formed as a result of the campaign inaugurated in Boston by the Edison Electric Illuminating Company. It has been a valuable adjunct in the campaign and has resulted in a more intimate association of the agents for electric vehicles and others interested in their introduction. The meetings are held in the Assembly Room of the Edison Building at noon on Wednesdays. The Edison Company furnishes a luncheon.

Municipal Railway in Tokyo.

In Tokyo, Japan, the municipality is taking over the electric street railways. Extensions to the existing lines will be constructed and new rolling stock produced.

Electric Railway Association Conventions.

Annual Sessions of the American Electric Railway Association and the Affiliated Accountants', Claim Agents', Engineering, and Transportation and Traffic Associations, Atlantic City, N. J., October 9-13 — Papers and Discussions — The New Officers — The Manufacturers' Association Exhibit.

The annual convention of the American Electric Railway Association, and the affiliated Accountants, Claim Agents, Engineering, and Transportation and Traffic Associations were held at Atlantic City, N. J., July 9-13. This was the largest and most important gathering ever held by the electric railway men, and it is understood, the largest convention ever held at Atlantic City by any interest or industry.

The sessions of the American Association were enlivened by the introduction of several addresses respecting public relations that aroused a great deal of enthusiasm. The entertainment features were rather more elaborate than usual, and greatly enjoyed.

On the following pages will be found a review of the proceedings of the meetings of the American Association, the Engineering Association, the Transportation and Traffic Association, and some brief notes respecting the Manufacturers' Association, the representatives in attendance and the exhibits.

The Claim Agents' Association held several important meetings and joint sessions with the affiliated associations. The following officers were elected for the ensuing year: President, H. K. Bennett, Fitchburg & Leominster Street Railway; first vice-president, C. A. Avant, Birmingham Railway & Light Company; second vice-president, R. H. Schoenen, Lehigh Valley Transit Company; third vice-president, W. F. Weh, Cleveland Electric Railway; secretary-treasurer, B. B. Davis, Columbus Railway & Light Company.

The Accountants' Association elected the following officers: President, P. S. Young, Public Service Railway, Newark, N. J.; first vice-president, L. T. Hixson, Terre Haute, Indianapolis & Eastern Traction Company; second vice-president, Elmer M. White, Coney Island & Brooklyn Railroad; third vice-president, N. E. Stubbs, United Railways & Electric Company of Baltimore; secretary and treasurer, H. E. Weeks, Tri-City Railway, Davenport, Iowa.

American Association.

The first session of the convention of the American Electric Railway Association was called to order by the president, Arthur W. Brady, of Anderson, Ind., at 2:30 o'clock, October 10. Mr. Brady presented his presidential address, saying in part:

The track mileage of street railways in the United States, estimated at approximately 3,000 miles in 1882, and grown to an amount slightly more than 8,000 miles by 1890, now exceeds, in the case of various kinds of railways, 41,000 miles, an increase of some 1,200 per cent, with over 4,000 additional miles under construction. The gross annual income now exceeds 250,000, and the number of passengers annually carried, estimated in 1882 at 1,212,000, is now 10,000,000,000. The four affiliated associations have given active attention to the various branches of electric railway operation. The record of the Accountants' Association in its continued cooperation with the Interstate Commerce Commission is noteworthy. Through this cooperation the dangers arising from an adoption of hastily formed, impracticable and erroneous theories are minimized. The Transportation and Traffic Association and the Accountants' Association have cooperated through a joint committee in the preparation of a standard method for the compilation of the expenses of freight and express traffic. The work at association headquarters is growing constantly and becomes yearly of increasing importance. The entire force at the office is entitled to commendation for its careful attention to the business entrusted to it, and to H. C. Donecker, secretary-treasurer of the association, is due especial praise for loyal, intelligent and energetic interest. During the year action was taken upon the recommendations of the committee on "Insurance" and Henry L. Staats, of Cleveland, was chosen as the expert of the association in charge of the insurance bureau. One of the noteworthy developments during the year is found in the extension of the idea of regulation by commission. The various measures enacted or urged, taken with others of the past few years, demonstrate that the atmosphere is now charged with the commission idea. Many students of the subject believe that the final step has been taken and that this system of regulation is the method which will be permanently followed. It is universally conceded that power to regulate public service corporations resides in the legislative branch of Government and it is undoubtedly true that from the standpoint of both the regulator and the regulated it should be possible to secure better regulation through a properly constituted commission having opportunity and facilities of investigation before acting than through the legislature itself. It is safe to say the commission form of regulation will fail unless in the appointing of the commissioners the ideal is pursued of selecting men who are fair-minded, experienced in affairs, well informed of the business which they are to regulate, and above all thoroughly imbued with the sense of their solemn duty as arbiters to decide all matters impartially and without bias whether the result be pleasing or the contrary to public or corporation. In establishing a proper conception upon the part of the public of the rights of the railway interests, the Association must assume leadership. The Association must wage a vigorous campaign to increase its membership both active and associate. Greater membership means greater usefulness. The company section plan of organizing the employees of the member companies of the Association is highly practical and would foster a more intelligent and personal interest in company business. It is recommended that this plan be given careful consideration. Through the work of the Manufacturers' Association the campaign to form just public opinion can be intelligently carried forward, and it is recommended that the associate membership of the American Association and the Manufacturers' Association be brought together. This matter is also commended to the earnest attention of the incoming executive committee.

The convention responded enthusiastically to the reading of the presidential address and after thanking his audience for their expression of appreciation, President Brady called for the report of the executive committee, which was presented by the secretary, H. C. Donecker.

Secretary Donecker presented the report of the secretary and treasurer.

At the close of the fiscal year 365 companies were enrolled as members, a net increase of fifteen over the number shown on September 30, 1910. The growth, however, is more substantial than this number indicates, as the total membership was considerably reduced because of a number of consolidations during the year which brought about a net loss of seven companies. Associate membership now totals more than 1,200, or a net increase of twelve per cent. The receipts for the year 1910-11 show a net gain of $3,072.52 over the year 1909-10. The expenses have increased $4,214.62, most of which is due to the greater amounts appropriated to the affiliated associations and to the increased cost of printing the annual proceedings which last year covered 2,100 pages as against 1,750 in 1909.

The report of the secretary and treasurer was received and the report of the committee on "subjects" presented. This was followed by the reports of the committee on "Active Membership," the committee on "Associate Membership," and the committee on "Public Relations."

The report of the committee on "Public Relations" suggested among

other things the preparation by some one experienced in publicity work, of articles bearing on different phases of railway work and arranging for the publication of this material so that it would come to the attention of the riding public.

In opening the discussion on these reports, James H. McGraw, president of the McGraw Publishing Company, quoted a paragraph from the address of Patrick Calhoun, president of the United Railways of San Francisco, at the 1910 convention of the Association. Mr. Calhoun said that no men come in such close contact with the people of the cities as those who manage their daily transportation. From this contact it is learned that the general public is utterly indifferent to what may be termed the private side of street railroading. Continuing Mr. McGraw said:

How can the public understand if no one tells the story? The industry does not understand, as a whole, the possibilities of molding public sentiment so that there shall be co-operation instead of antagonism toward the purposes of the corporations. For the larger companies, a definite policy of publicity and a specially organized department, with a capable head to handle this feature, are as necessary as a general manager. Newspaper men should be treated frankly and trusted. They are in a sense the representatives of the people. If they are shown that the railroad has nothing to conceal, that it is glad to assist them in any legitimate inquiry, and that officials are willing to see them at all possible times, they will naturally assume a more friendly attitude.

Commenting on the suggestions made in the president's address, Mr. McGraw said that the Association was in a natural position to point the way in this important problem and work of public relations. Membership of every class should be increased. Every member of the affiliated organizations should become an associate member of the parent organization. The company section idea was a good one, and every employe and every manufacturer, all along the line should be preaching this same gospel, telling the same story, in the interest of this great industry.

P. S. Arkwright, of Atlanta, Ga., emphasized the necessity, particularly in the smaller towns, of giving good service at a reasonable fare and demanding uniform courtesy from the employees of a railway company in their relations with the passenger. The railway company is continually asking for favors from the public and while the public often makes unjust demands, it is as a rule responsive to generous treatment, and in most cases submits to a great deal of inconvenience which, insofar as the railway company is concerned, is impossible to prevent, but on the other hand appears to the public to be unreasonable. However, the railway company even under unjust treatment cannot afford to become antagonistic to the public. In every event it should attempt to keep a little in advance of reasonable public demands.

The report of the committee on "Education" was presented by Professor H. H. Norris. The essential features of the report of the committee has to do with the actual training of employees so that they might become of greater advantage to the institution employing them. The committee had done some experimental work with the aid of four or five companies, with twenty-seven young men during the past summer, and this experiment it was announced was fairly satisfactory. The committee recommended that the experiment be continued another year and that the number of students enrolled be increased to 100.

Charles L. Henry, president of the Indianapolis & Cincinnati Railway Company, was introduced and delivered an address on "The Interurban."

Just before the close of the session a telegram was sent to W. Caryl Ely, congratulating him upon his recovery from his recent illness. The meeting then adjourned.

The second session of the American Association was called to order by President Brady at 2:30 o'clock Wednesday afternoon. After the appointment of the Nominating Committee a paper on "Measures for the Welfare of Employees" was presented by Daniel T. Pierce, of New York.

J. G. Cannon, president of the Fourth National Bank, of New York, made an address on "Electric Railway Securities." This paper discusses in detail the effect upon the value and distribution of these securities in relation to popular opinion.

A paper describing the physical and operating features of the Hudson tunnel was read by J. V. Davies, chief engineer of the Hudson & Manhattan Railroad.

General George H. Harris, vice-president of the Washington Railway & Electric Company, presented a paper entitled, "The Effect of Electric Railway Operation on Taxable City Property."

EFFECT OF RAILWAYS ON PROPERTY VALUES.

The countrywide belief in the enormous profit accruing from operation of electric railways has failed in many cases of materializing. Notwithstanding the enormous benefits conferred upon real estate and manufacturing interests, however, the authorities are unwilling to concede overmuch to public utility corporations. Since 1902 the electric railway development in the District of Columbia has added directly about $46,000,000 to the land values (without considering the vast transfer benefits) and is responsible for a steady increase which in a large part of the territory now exceeds one hundred per cent annually. The railways that did the work have accumulated a deficit of more than a million dollars with further deficits in prospect for two or three years to come. Who is the debtor?

Albion E. Lang, president of the Toledo Railways & Light Company, presented an able and interesting paper on "The Toledo Street Railway Situation."

TOLEDO STREET-RAILWAY SITUATION.

The present system of the Toledo Railways & Light Company is the outgrowth of the old horse-car system consolidated with the lines of the Toledo Consolidated Street Railway Company, and the Toledo Electric Street Railway Company. During the earlier period of development, owing to certain restrictions placed upon the electric railway company in using the tracks of the horse-car railway company to enter the heart of the city, the lines were laid out in a haphazard and unscientific way, to the detriment of operation and reducing materially the securing of efficient traffic movement. The railway situation, particularly as regards the granting of franchises and the establishment of uniform rates of fare, has always been the subject of political contest, and the spirit of antagonism manifested toward the railway has put a stop to terminal construction, the building of extensions into districts really needing service, and hampered greatly the natural development of the city. Although the officials of the company have met the city council in both executive and open session it has been impossible to arrive at a fair means for determining a solution of this problem. Some of the city officials and business men of the city have made sincere efforts to bring about a settlement of this situation, but the public mind has been so poisoned by the abuse of capitalists and corporations in general for so long a time that many men, especially those holding public office, have become so intimidated that under no circumstances can they be betrayed into a defense of either. Mr. Lang has said, in private and upon public occasion, that the manufacturing interests of the city, as well as the real estate and banking interests, can in no way be as rapidly stimulated and improved as by a speedy and just settlement of the franchise question. There is a large body of very intelligent and energetic young business men and the question is now being discussed from this viewpoint, and it is expected that the matter will soon receive the careful and unbiased consideration its importance deserves, and that this will result in a settlement of all differences in a manner mutually advantageous to the city and the railway company.

On Thursday afternoon the closing session of the American Association was opened with the reading of a communication from Thomas A. Edison suggesting the appointment of a committee to investigate the storage battery cars now in operation in various parts of the country.

President Brady said the matter might wisely be referred to the Engineering Association with the suggestion that it investigate the general subject of storage battery cars if it should think this proper.

The remainder of the session was devoted to the announcement of the award of the Brill prize, the reports of committees.

The following officers were elected:

President, Thomas N. McCarter, Public Service Railway, Newark, N. J.

First vice-president, George H. Harries, Washington Railway & Electric Company, Washington, D. C.

Second vice-president, Charles N. Black, United Railroads of San Francisco, San Francisco, Cal.

Third vice-president, C. Loomis Allen, Syracuse Rapid Transit Railway, Syracuse, N. Y.

Fourth vice-president, Charles L. Henry, Indianapolis & Cincinnati Traction Company, Indianapolis, Ind.

Engineering Association.

The first session of the Engineering Association was held on Monday afternoon with President Harvie in the chair. Mr. Harvie's presidential address was devoted principally to the work of the committees. He also made the statement that an index of the proceedings of the Association was to be issued as soon as possible after the convention. Reports were then made by the Executive Committee and by Secretary Litchfield.

The report of the Committee on Education of Engineering Apprentices was then presented by the chairman, Walter H. Evans. This report included a code of apprenticeship rules and laid out a course for apprentices as electric car mechanics. A long discussion ensued in which members gave their opinions and experiences with different schemes and different types of young men. Several of the speakers favored giving preference to graduates of manual training schools, Y. M. C. A. courses, and correspondence schools. Edwin D. Dreyfus explained the system of the Westinghouse Machine Company. Farley Osgood stated that for power-house and transmission-line work it was found useless to train any but engineering graduates. Fred G. Simmons called attention to the system of the Santa Fe Railroad where regular classes in instruction are given to the apprentices during the working hours. For car-shop work, however, the general opinion was that it was preferable to have boys without a technical education and that particular attention should be given to developing their abilities, and giving them a general training in the work.

The report of the Committee on Power Distribution was then presented by the chairman, A. F. Hoovey.

REPORT ON POWER DISTRIBUTION.

This report includes specifications for cables, for rubber compound, for hard-drawn copper trolley wire, and for overhead crossings of lighting and power-transmission lines. These specifications are not amenable to abstract. There is also a discussion of concrete, latticed and tubular poles. The introduction of concrete poles has been handicapped by a recommendation for general adoption, but for special cases the committee believes that it has merit. Construction and cost data are given for reinforced concrete poles and comparisons made with the cost of cedar poles. Valuable details are given but cannot be reproduced here. Comparative strength tests of concrete and cedar poles are given, including the deflection under side strain, and the method of failure. Appendices are added giving figures for wind and ice loads, conductor sags, specifications for galvanizing for iron and steel, pole formulas, and drawings of typical crossings.

The discussion of this report was concerned mainly with the details of the specifications and with the use of reinforced-concrete poles. The latter were considered by many of the speakers to be desirable for special purposes but hardly to be recommended for general use as they cannot yet compete with wooden poles on the basis of cost. Farley Osgood considered them unsuited for use where the poles are also used for carrying high-tension lighting circuits, as it is dangerous for the men who must work on the poles with live wires. The danger of trouble from electrolysis was discussed by Harry Barker, C. W. Palmer, R. D. Coombs and others, but there seemed to be no definite data available on this point. L. P. Crecelius told of some experience in replacing steel poles by reinforced concrete. The cost was $10.71 each as against $16.38 for tubular steel poles.

President Harvie called the Tuesday session to order at 10 a. m. The entire session was devoted to a discussion of the report of the Committee on Heavy Electric Traction. This report was presented by E. R. Hill.

HEAVY ELECTRIC TRACTION.

The committee has confined its attention to three subjects: (1) location and clearances for third-rail working conductors; (2) location of electrical end connections on cars and locomotives; (3) location of automatic train stops. Respecting the first, through co-operation with committees from several steam-railroad associations a standard clearance diagram was drawn up. This provides that the gage of the third rail shall be between 26 and 27 inches outside the gage of the main rails and the contact surface of the third rail shall be between 2.75 and 3.5 inches above the top of the main rails. The diagram shows the limiting clearances between third-rail structures and rolling-stock; a carefully defined zone at least one inch clear shall separate them. No standards for electrical end connections on cars are as yet recommended. A clearance diagram for automatic train stops is submitted as recommended practice.

A subcommittee co-operated with the American Society for Testing Materials in the preparation of standard specifications for axles, shafts, etc., of heat-treated carbon steel. Rigid chemical and physical tests are laid down.

A brief letter was presented from E. B. Katte in which he particularly urged the adoption of the recommendations on third-rail clearance. R. C. Currie also agreed as to the value of a standard clearance diagram. He thought that the definition of a bond was superfluous, however.

F. G. Simmons moved the adoption of the report and that the final adoption of the standard therein recommended be referred to the Committee on Standards. After some discussion on the effect of such action, the motion was carried. C. B. Kaiser then introduced a resolution to the same effect respecting the recommended practice on heat-treated axles, shafts, etc. This also carried, but was reconsidered to permit of discussion.

F. R. Phillips desired to see the nature of the heat treatment more definitely specified. E. R. Hill thought it was unwise to specify and indorse any particular process, because it was the province of the manufacturer to adopt one that suited his conditions. Scarcely two makers employ the same process.

Secretary Litchfield said the manufacturers had been consulted in the drafting of the report and it had been adopted by the American Society for Testing Materials. C. W. Palmer also indorsed the tests recommended since those clearly indicated what performance the steel should give. The manufacturers should determine how they would produce the grade of steel required.

In reply to a query whether such steel could be produced without special heat treatment, H. P. Tieman, of the Carnegie Steel Company, said the physical tests imposed could not be met unless the steel received very careful heat treatment. G. E. Thackery agreed with him. H. Gulick and D. F. Kenney discussed the matter of inspection during the manufacture.

Mr. Kaiser's resolution was then readopted and the recommendations referred to the Committee on Standards.

JOINT MEETING ENGINEERING AND TRAFFIC ASSOCIATIONS.

The joint meeting of the Engineering and the Transportation and Traffic Associations was called in the Greek Temple to consider the report of the Joint Committee on Block Signals for Electric Railways. The report was presented in abstract by J. M. Waldron, chairman.

BLOCK SIGNALS.

This report comprises a discussion of the general subject of block signaling giving a description of the systems of signaling and dispatching in use on the various high-speed electric railways of the country and suggesting recommendations as to the essential requisites of a proper signaling system and those requisites which are not absolutely necessary, but desirable. Both automatic block signaling and manual signaling are considered. A list of the roads which are or have installed block-signal systems during 1911 is given. The report concludes with a list of suggestions to be followed by a similar committee next year. Supplementing the report proper is a list of twelve appendices dealing with descriptions of block-signal installations and giving illustrated descriptions of apparatus manufactured by the signal manufacturers.

Herbert V. Balliett opened the discussion by first praising the work of the committee. Taking up the signal problem, he felt that the upper left quadrant was the best and most legible one to work the signals in. A careful study should be made of this matter and an attempt made at standardization before much signaling work is attempted. The choice between a plain light signal and one having a semaphore auxiliary must also be made. The former is a much cheaper one, but has a relatively short range on a bright sunny day. He preferred the combina-

tion arm and light. From the experience of the Park Avenue Tunnel in New York City, he was convinced that electric light signals can be made practicable. The possible danger from lamps burning out can be overcome by use of duplicate lamps so arranged that if one burns out the other is automatically cut in. But in any case close inspection and maintenance of the system is necessary.

L. E. Gould said that on those roads where signals have been installed this has invariably increased the good will of the public toward the road in appreciation of the evident desire to safeguard the public interest. The operating men have in all cases been enthusiastic over the installation.

John Roberts said undoubtedly cost is the great bugbear in all signal work and it has been a serious problem for signal engineers to provide effective signaling installations with the meager appropriations available. Some roads cannot be started to do anything in this line until there have been a number of wrecks.

W. K. Howe made an appeal to the electric railways to try to have greater uniformity than the steam roads employ in their signaling. He also spoke of the use of double lights in signal lanterns. Only one of these can be in the focal center of the lens, but when the other is automatically cut in it is quite serviceable though not so brilliant.

C. D. Emmons called attention to the valuable aid given by the signal-manufacturing companies in the preparation of the report and to the fine exhibit of signaling devices made at the convention.

F. L. Howard said standardization of signaling systems and devices would not be easily attained because of the varying conditions on different roads. For many interurban trolley lines he thought the light signal would be preferable to semaphores.

Charles Morrison thought the combination light and semaphore signal was preferable. In any system rigid maintenance is necessary. He described the New Haven signaling system and the use of two lamps in signal lanterns.

Others participating in the discussion were G. W. Palmer, Jr., H. M. Sperry, H. W. Griffin, and Presidents Harvie and Page of the two associations. J. M. Waldron closed the discussion by urging that original cost be not given too much prominence. More important factors are the protection to be secured, the reduction in accidents and injuries to passengers, and the increased capacity for traffic.

On motion of C. Loomis Allen the committee was continued and its recommendations referred back for further consideration.

JOINT MEETING ENGINEERING AND ACCOUNTANTS' ASSOCIATIONS.

On Wednesday morning a joint meeting of the Engineering and the Accountants' Associations was held, W. H. Forse, Jr., presiding. The topic for consideration was the report of the Joint Committee on Engineering Accounting; this was briefly presented by P. S. Young.

ENGINEERING ACCOUNTING.

The report of the joint committee takes up three topics. The first is scientific management, the study of which is urged upon both accountants and engineers, a long bibliography on the subject being given. In the second part, the last report of the committee is reviewed and a few amendments made to the recommended subdivision of operating maintenance expense accounts. The third part deals with the question "What constitutes maintenance?" The rulings of several public service commissions are given on the subject. The conclusion is that renewals as well as repairs should be included in maintenance, even when a separate depreciation reserve account is kept, because the latter should be a subdivision of the maintenance account.

Discussing the subject of scientific management were H. H. Adams, Harrington Emerson, Walter H. Evans, J. H. Neal and Charles Hewitt.

A lively discussion of maintenance followed. It showed a marked difference of opinions on just what should be included under maintenance. Among the points discussed were how abandoned property should be accounted for, how depreciation should be taken care of, the relation of the annual inventory to the maintenance problem, the degree of maintenance that should be kept up, the labor charge for slight betterments, and the relation of obsolescence to maintenance. Those who took part in the discussion were W. F. Ham, H. Emerson, J. H. Neal, M. Schreiber, T. E. Rust, P. S. Young, H. G. Stott and C. Hewitt. On Mr. Ham's motion the committee was continued for another year.

Directly after its joint meeting with the accountants, the Engineering Association held a separate session, at which a Nominating Committee, composed of F. C. Simmons, C. Hewitt, C. H. Clark, W. Roberts and F. R. Phillips, was first appointed. The report of the Committee on Power Generation was then presented by L. P. Crecelius, chairman.

POWER GENERATION.

The report of the committee is in four parts. The first of these is on developments in the generation of steam. Reference is here made to three indicating instruments to show what a boiler is doing; these are a Venturi meter to measure the feed-water input, a steam-flow meter to show the steam output, and an instrument to measure the coal fed to a boiler. Methods of forcing a boiler are discussed. The second part deals with the best standard voltage to be adopted for three-phase turbo-alternators with reference to size as related to voltage. From the transmission standpoint for plants less than 50,000 feet from their substations, 11,000 volts seems the most suitable voltage. Although designers find it difficult to provide the necessary space for insulation in large generators of this voltage, the use of voltage-changing transformers is regarded as undesirable. Therefore 11,000-volt generators are recommended. In the third part of the report, that dealing with direct-current turbo-generators larger than 500 kilowatts in capacity, the practice of one electric manumacturing company is given; this advises the use of a reduction gear for such generators. The last part of the report is devoted to the purchase of bituminous coal under heat-unit specifications. The United States Government practice is cited and the specifications of the Cleveland Railway Company and of the Interborough Rapid Transit Company are given in detail.

The discussion of the four topics considered in the committee's report was taken up in the order these had been presented. In regard to boiler practice, C. Hewitt questioned the economy of forcing boilers beyond thirty to forty per cent over their rating and cited a case where forced draft had driven out tons of fine coal particles. W. Roberts advocated an intelligent use of forced draft, however; there is decided need of more skilled men to operate the boiler equipment.

H. G. Stott contended that if a boiler plant can be forced to carry the railway peak loads some percentage of efficiency can be sacrificed because of the greater saving in fixed charges. He believed that within a year it would be possible to operate a boiler at 300 per cent of rating during peak loads. The use of the three instruments he had described in the report was primarily to compare one boiler with its neighbors; the accuracy of the instruments need therefore not be extremely high. The deterioration of double-stoker boilers is no greater than that of boilers with a single stoker. Others who discussed boiler performance were E. J. Burdick, T. E. Rust and B. F. Wood.

E. N. Lake took up the question of generator voltages. The committee's conclusions with regard to transmission voltages should be applied with great care. Its disapproval of the use of reactances and transformers is contrary to the present practice of very large operating companies. The generator voltage is a matter of design and insulation and does not necessarily depend on the transmission voltage.

H. G. Stott fully concurred in the committee's finding and disagreed with Mr. Lake on several points. He did not believe it was desirable to go above 11,000 volts for underground transmission.

In regard to the last topic in the report, C. Hewitt, W. Roberts, E. J. Burdick, J. H. Hanna, H. G. Stott, C. P. Crecelius and Messrs. Bayne, McCullough and Rand discussed various features connected with the purchase of coal on heat-unit specifications.

The session on Thursday morning was devoted to the reports of the Committee on Buildings and Structures and the Committee on Way Matters. The first report was presented by Martin Schreiber, chairman, and dealt with economical maintenance, proper facilities for employees, proper installation for fire protection of car houses, and

contained a number of appendices dealing with the details of these subjects. It was followed by a long discussion devoted mainly to the subjects of rolling doors, lunch rooms and amusement rooms for employees, the instruction of the latter in proper fire protection, and the use of wire-glass. The part of the report giving instructions to employees was adopted.

J. M. Larned presented the report of the Committee on Way Matters. This report presented an investigation of rail sections and rail joints, shop facilities and rules of government for the way department, and the nosing of cars. The discussion of this report was concerned mainly with the adoption of the standard rail section and although the section presented by the committee was generally favored, no final action was taken. The rules and regulations for the government of employees was adopted as recommended practice.

At the session on Friday morning, the first report presented was that of the Committee on Equipment by M. V. Ayres.

REPORT ON EQUIPMENT.

In dealing with the heating and ventilation of cars, the committee shows that under average conditions electric heating is more expensive than the use of hot water or hot air, the hot-air system being the cheapest. The high cost of electric heat is due primarily to the cost of power, which is estimated on the basis of 1.4 cents per kilowatt-hour. All other elements of cost are cheaper, and the regulation is best. The use of thermostatic regulators with electric heating is recommended, as it is anticipated that a saving of fifty per cent in power could be effected by this means, in which case the cost would compare favorably with the other methods of heating. The tendency of car crews is to use less coal than necessary to keep a uniform temperature, but with electric heating the tendency is to use more current than necessary. The design of car bodies, car trucks, and other electric equipment is considered with reference to securing light weight. In the effort to reduce the weight of motors the following methods have been investigated: (1) Redesign of motors with special reference to elimination of unnecessary material. (2) Use of higher speeds with greater ratio of gear reduction. (3) Forced ventilation. (4) Raising the working temperature by the use of heat-resisting insulation. (5) Field control. The report discusses what has been accomplished in this line and what the prospects are for future progress.

In the discussion of this report it was brought out that the use of thermostatic regulators where tried had met with great success and resulted in considerable saving of power.

Reports were then heard from the Committee on Rules of Procedure of the Committee on Standards, from the Committee on Standards, and from the Nominating Committee. The report of the Committee on Question Box was not taken up in detail, but the work received very much praise. It was decided to continue this feature.

The following officers were elected for the ensuing year: president, E. O. Ackerman, Columbus, O.; first vice-president; Martin Schreiber, Newark, N. J.; second vice-president; L. P. Crecelius, Cleveland, O.; third vice-president, John Lindell, Boston, Mass.; secretary-treasurer, Norman Litchfield, New York, N. Y.; executive committee, J. H. Hanna, Washington, D. C.; E. J. Burdick, Detroit, Mich.; E. A. Hill, New York, N. Y.; H. A. Mullett, Milwaukee, Wis.

Transportation and Traffic Association.

The first session of the convention of the Transportation and Traffic Association was called to order Monday afternoon by President Page who then delivered the annual presidential address.

President Page called attention to the encouraging growth of the Traffic and Transportation Association and then commented on the program of reports that were to be presented. He explained that the various committees were appointed directly after the convention last year, thus affording ample time in which to carry on the work assigned. The Executive Committee this year adopted the plan of rather definitely fixing the lines of investigation for the various committees. This plan, President Page said, was exceedingly helpful and should be followed hereafter. Each individual report was then commented upon briefly and in conclusion Mr. Page thanked the various committeemen for their earnest work and the member companies for their co-operation.

The report of the Executive Committee was then presented by Secretary Donecker who then presented his annual report. This report was exhaustive in character, giving interesting information relative to the work and financial condition of the Association. The report was accepted and the secretary given a vote of thanks for his work.

President Page then appointed a Committee on Resolutions consisting of Messrs. Snyder, Johnson and Moore. J. N. Shannahan next read the report of the Committee on Subjects which was subsequently accepted.

The report of the Committee on Training of Employees was next in order, but President Page announced that this committee did not have a report ready. He asked for an open discussion on the subject, however.

A. E. Learned was the first speaker. He presented some interesting statistics on the number of new men employed by the Boston Company during 1911, the number applying for positions, number of applications rejected on sight, number of applicants to pass examinations, etc. The company has about 160 men capable of instructing applicants, these instructors are paid ten cents per day extra. Mr. Learned then read a letter of advice to new motormen and conductors which is sent to all new employees.

In reply to a question by M. C. Brush, Mr. Learned said that the men being instructed were paid a salary of $1.00 per day.

L. H. Palmer said that the training of men should be considered under the divisions of first, the selection of men; second, their preliminary training; third, their training for the first few weeks after appointment; and fourth, some form of permanent training. He explained in detail the system of training used by the Metropolitan Street Railway of New York.

N. W. Bolen described briefly the system employed for training employes by the Public Service Railway, of New Jersey. F. C. Cherry, J. V. Sullivan and C. J. Griffith also contributed to the discussion on this subject, outlining briefly the training systems employed in their various cities.

The report of the Committee on Passenger Traffic was then, in the absence of Chairman Pellissier, read by J. E. Gibson.

PASSENGER TRAFFIC.

The report of the Committee on Passenger Traffic discusses the questions of civic organizations as related to such traffic, newspaper advertising, advertising costs, the employment and duties of industrial and passenger agents and commutation rates. Reports gathered by the committee from 100 cities show every one to have a civic organization of some sort and in several of the cities these have been instrumental in securing new factories. The report suggests that railways co-operate to a greater extent with the civic bodies. The committee requested information on the general practice of the members in regard to advertising and of the replies received sixty-three advertised and thirty-four did not. Regarding advertising affecting public relations twenty-two companies reported that they advertised along these lines and fifty did not. As to passenger agents, of the replies received twenty-eight employ and fifty-nine do not employ agents of this kind. Regarding commutation rates the replies received show that twenty-five companies operating interurban lines issue commutation rates and nineteen companies do not; that thirteen companies believe such rates to be profitable in themselves, and ten companies consider them unprofitable. Eight companies feel that commutation rates induce sufficient regular riding to make them a source of profit and nine companies state that such rates are not responsible for any substantial increase in regular business.

C. R. Gowen, L. D. Mathes and J. S. Moore discussed this report. Mr. Gowen briefly discussed excursion business and explained the methods of advertising of the Oneida Railway.

Mr. Mathes spoke particularly of that section of the report dealing with civic organizations. He emphasized the value of such organizations and urged all public-utility companies to enter into and encourage them. Several incidents were recounted showing what could be done towards obtaining new industries for a locality and how this influences railway business.

J. S. Moore spoke of the value of building up the "everyday" business. He also advocated railways taking an

active and financial interest in civic organizations and referred briefly to such an organization in Syracuse (N. Y.), mentioning the scope of its work. The Syracuse Company's advertising methods were also described. The meeting then adjourned.

TUESDAY MORNING SESSION.

President Page called the meeting to order shortly after 10 a. m. and announced that the first business would be the report of the Committee on Interurban Rules. Before the report was presented a motion was made to refer the report back to the committee. This motion was withdrawn and Alexander Shane presented the report.

Mr. Shane added that since the report was printed the committee had received criticisms from a number of members. These had been given due consideration and a number of changes in the printed report were made.

Charles L. Henry called attention to rules which the association had adopted at the Denver convention and said that although they had been before the committee for two years no important changes were found necessary. He urged that action be taken at once to adopt those rules, as he thought that sometime in the near future the Interstate Commerce Commission would take up the question of rules with interurban companies and the latter should go on record as to what they thought was a proper code.

W. B. Rockwell also urged that definite action be taken on the adoption of the code as proposed.

C. Loomis Allen recommended that the committee suggest some form of procedure whereby the convention could take up their recommendations section by section and either adopt or reject them.

James W. Brown said that as the Denver code of rules was adopted and is therefore standard only the rules which are changed are the ones necessary to discuss.

In accordance with this and upon motion of F. W. Coen the numbers of the rules affected were read and each discussed in detail. Among those taking part in this discussion were C. D. Emmons, F. W. Coen, J. W. Brown, Alexander Shane, Joseph K. Choate and J. N. Shannahan.

C. Loomis Allen then presented a resolution adopting the present code of rules as amended and requesting the Committee on Interurban Rules to be continued and report next year. The resolution was adopted.

WEDNESDAY MORNING SESSION.

The meeting on Wednesday morning was called to order promptly at 10 a. m. and President Page appointed a Committee on Nomination, consisting of Robert I. Todd, C. L. Allen and Bruce Cameron. The report of the Committee on City Rules was then presented by H. W. Fuller, chairman.

CITY RULES.

This report covers several amendments to the present code rules; new code rules; list of titles for local rules; code of car-house rules; and prepayment-car rules. Data sheets outlining these changes were sent to 294 member companies and replies were received from 147. All of the changes have been approved by a majority of those replying.

I. H. McEwen opened the discussion, calling attention to several phrases on the title page of the rules, which had been changed from the standard code. Mr. Fuller replied that these changes do not change the standard code.

A motion was made by R. E. Danforth and carried, providing that the "general notice" section of the rules be made to conform in all respects to the "general notice" adopted for interurban rules.

A general discussion of the individual rules was then taken up. Rules 2 to 10 were first discussed by H. W. Fuller, I. H. McEwen and R. E. Danforth. Regarding backing of cars Mr. Danforth objected to the phrase, "whenever danger would likely result" motormen must always change ends on double-end cars. He moved that this be stricken out. The motion was lost.

Other recommended amendments were taken up one by one. Considerable of the discussion revolved about the wording of particular phrases rather than a radical change of the amendments themselves. A very lengthy discussion took place regarding rule 108 which states that passengers have a right to ring the bell to stop the car and conductors must bear this in mind. A motion was made by R. E. Danforth that this rule be rejected. Messrs. Clifford, Fuller, Brush, Choate, Hathaway, Kiernan, Badgers, Allen and Cherry discussed this subject. The rule was finally amended to read "When a passenger rings a signal bell, conductor must try in a polite way to discourage the practice."

L. H. Palmer then read a communication from J. L. Quackenbush, on the subject of assisting passengers.

A motion was then made by C. L. Allen to adopt the present code, with the changes as discussed, up to the section dealing with prepayment-car miles. M. C. Brush made a motion that a similar resolution be adopted with reference to the prepayment car. Both motions were carried.

The report of the Committee on Express and Freight Traffic was then presented by F. W. Watts.

EXPRESS AND FREIGHT TRAFFIC.

This committee sent out a list of fourteen main questions to member companies asking for information as to the methods of securing business, methods of handling claims, transportation of baggage, transportation of newspapers, transportation of milk and cream, types of cars used, etc. Replies were received from 110 companies and these are tabulated both as regards the individual questions and for all questions. All replies indicate a steady increase in freight and express business. The committee makes several recommendations based on the replies received and suggests that this business has now grown to such proportions as to warrant a separate accounting system segregated from passenger business.

Charles E. Beattie opened the discussion on this report. The roads with which he is connected operate on a purely freight business and at a profit. Single cars are operated and no carloads are handled, the business being principally package freight and small shipments. No solicitors are employed to obtain new business although the companies advertise extensively. Claims are settled between the claim department and the express department. One of the roads referred to handled freight in one direction only, but made an excellent showing as regards profits.

F. D. Norviel spoke of the freight conditions in the northern central states, particularly around Indianapolis, Ind. He explained the freight service between Indianapolis and Ft. Wayne and Indianapolis and South Bend. In reply to questions by E. C. Spring he said that the rates charged were about the same as those charged by the steam roads; also that about eleven per cent of the gross business of the company was derived from freight.

THURSDAY MORNING SESSION.

The session on Thursday morning was called to order by President Page shortly after 10 a. m., and the report of the Committee on Fares and Transfers presented by M. R. Boylan, chairman.

FARES AND TRANSFERS.

The title of this committee was changed from "Transfers and Transfer Information" to Committee on Fares and Transfers, and the scope of its work was increased to include all matters having to do with the subject of fare collection and registration, whether of cash, tickets or transfers. Information was solicited from member companies and the replies are tabulated in convenient form. The report also discusses methods of fare collection on prepayment cars, transfers in connection with prepayment-car operation, and modifications of the transfer laws. The replies to the various questions were varied and no conclusions are drawn by the committee.

E. J. Cook opened the discussion outlining the changes in the transfer system of the company he represents. The new transfer only carries two punch marks so that the conductor can issue transfers with a minimum amount of labor. Different colored transfers are used each fifteen minutes, the color indicating the expiration of the time limit on the transfer, the two punch marks indicating the hour and the line on which the transfer is good. Mr. Cook explained that some trouble was encountered at first in introducing the new system but the company carried on extensive publicity campaigns and explained their position thoroughly.

C. E. Learned discussed the report at some length commenting particularly on the lack of progress that has been shown in the matter of collecting

fares. Regarding transfers he held that the present form of transfer in use is responsible to a large measure for delays in issuance and acceptance. He suggested that transfers be printed for each line of a system and contain only the names of the transfer points on such line. Standard forms of transfers should be adopted by the Association. In conclusion Mr. Learned spoke of the existing laws governing transfers and then discussed in detail numerous recommendations of the committee.

Bruce Cameron described briefly the transfer system in use in St. Louis. A so-called "fifteen-minute" transfer is used. They are counted each trip.

M. C. Brush spoke of the method of checking transfers received from conductors against those issued. This subject was also discussed by Messrs. Learned and Cameron. The point was brought up that where transfers were only counted and not checked, the conductor could substitute transfers for cash fares in his accounts.

C. D. Emmons thought that by requiring the conductor to deposit his transfers and punch with the company every night some of the misuse would be eliminated.

J. J. Anderson explained the transfer system used by the company he represents, in connection with a terminal station. Transfers are issued at the terminal by the motorman and conductors as the passengers are leaving the car. These passengers enter an enclosure where they can board any car leaving the terminal and the transfers are honored on any car leaving the same day. Passengers who leave the enclosure forfeit their transfers.

After some further brief discussion the report of the Committee on Construction of Schedules and Time Tables was presented by I. H. McEwen.

SCHEDULES AND TIME TABLES.

This committee presented first a list of definitions of terms relating to time tables and schedules which were requested at the last convention. Reports are also made on the subjects of division of work among extra men and re-routing. It is recommended that the use of the revolving extra list be modified to establish a certain number of hours of work as a day's work for extra men, such extra men not to fall back on the extra list until they have had an opportunity to obtain such stated number of hours' work. The committee recommends that the advantages of possible re-routing of lines be investigated. Several recommendations are also made respecting the issuance and style of time tables.

C. D. Emmons opened the discussion on this report. He asked if the committee gave consideration to the standardization of leaving time for companies which operate limited and local cars. I. H. McEwen replied that the committee considered this purely a local subject to be governed by the length of time, number of cars operated, etc.

H. A. Nicholl also spoke briefly on the point brought up by Mr. Emmons. He thought that it was good practice for interurban companies to start their cars from the larger terminals on the even hour and half hour with locals in between. Regarding the subject of showing freight train on time tables Mr. Nicholl thought this good practice if the freight business is standard. He also thought it good policy to print new time tables on different-colored paper. After some further brief discussion the report was accepted and the paper by C. J. Franklin, entitled, "Two-Car Train Operation for City and Suburban Travel," was presented by C. J. Franklin.

TWO-CAR OPERATION.

This paper states that where traffic conditions are favorable, two motor cars coupled together, operated and controlled by one motorman, have decided advantages over single-unit operation and are especially advantageous when two-motor equipment is so utilized. The traffic conditions which have made train operation desirable are briefly described and a brief discussion of the advantages of train operation and the comparative merits of single car versus trains given. Some of the advantages mentioned for two-car train operation are: the two-car train operation is much smoother in every respect—has increased acceleration and permits of more rapid operation and regularity of schedule than trailer operation. It lessens the danger of the switching required to run around the trailer at the end of the line. This consumes time, frequently to such an extent as to interfere with schedules to say nothing of the accident risk involved. The paper is concluded with a description of the equipment of the city and suburban cars used by the Portland (Ore.) Railway, Light & Power Company.

This paper was discussed at some length, C. N. Wilcoxon opening the discussion. He spoke particularly of the condition that confronts the interurban companies in the Middle West, namely, operating out of the larger cities for a considerable distance where traffic is heavy during the morning and evening hours with a comparatively light traffic during the intervening hours, and in connection with this operating through a sparsely settled district. The traffic can only be handled during the rush hours by increasing the number of single units rather than increasing the number of schedule trains.

H. H. Adams spoke in favor of cars with a center entrance for multiple-unit operation. He thought that this type of car had several advantages over the car with two end platforms. The most important is that the seating capacity is increased. The question of doors has to be considered, however.

A communication was read from P. N. Jones in which he advocates trailer operation in preference to multiple-unit operation. Mr. Storer of Pittsburgh upheld Mr. Franklin's paper advocating multiple-unit operation and explained conditions in Pittsburgh on which he based his conclusions.

F. E. Case spoke of the practice of using a cylinder controller on the front car, of a multiple-unit train, to operate the motors. He thought that the street multiple equipment is much more flexible with two-car operation.

W. H. Sawyer said that in many cases the cost of multiple-unit equipment was prohibitive and he advocated a renewed consideration of trailer operation. The overworking of motors in single-unit operation is the only important difficulty and a judicious selection of equipment together with modern operating practice could practically eliminate this draw back.

E. C. Spring and Clarence Renshaw also discussed this paper briefly.

The report of the Nominating Committee was then read and the secretary instructed to cast the ballot of the Association for the nominees. The following were then declared duly elected:

President, J. N. Shannahan, New York, N. Y.

First vice-president, Dana Stevens, Cincinnati, Ohio.

Third vice-president, M. C. Bush, Boston, Mass.

Second vice-president, D. A. Hegarty, New Orleans, La.

New members of the Executive Committee are: A. Gaboury, C. F. Handshy, C. B. Buchanan, and H. A. Nicholl.

J. N. Shanahan then made a brief address of acceptance, following which the meeting adjourned.

Manufacturers' Association—Exhibits.

The American Electric Railway Manufacturers' Association held its annual meeting on Wednesday afternoon. President Castle presented the report of the Executive Committee, and stated that the membership was 328, an increase of sixteen for the year. The exhibition space this year, aside from that occupied by track exhibits, was estimated at 76,370 square feet. He urged every member to have in mind and to work consistently for an increase in membership.

Arthur W. Brady, president of the American Electric Railway Association, addressed the meeting, thanking the Manufacturers' Association, personally, and in behalf of the American Association for its assistance in making the convention so successful. He outlined several suggestions for effecting a closer cooperation of the manufacturers and representatives of the railways in promoting a campaign for improving the conditions affecting the relations of the railways and the public.

James H. McGraw was called upon to explain what had been done by a joint committee of the American As-

sociation and the Manufacturers' Association with respect to closer working relations between the two associations.

Five members of the Executive Committee, to serve three years, were elected as follows: E. A. Hegeman, Jr., president United States Metal & Manufacturing Company, to succeed C. C. Castle; C. S. Hawley, president Consolidated Car Heating Company, to succeed himself; James H. McGraw, president McGraw Publishing Company, to succeed himself; M. C. Miller, Allis-Chalmers Company, to succeed J. R. Porter, and C. R. Ellicott, Westinghouse Traction Brake Company, to succeed J. R. Ellicott. H. C. Ebert, president Cincinnati Car Company, and W. L. Conwell, president Transportation Utilities Company, were recommended to fill the unexpired terms of the offices to which they had been elected by the executive committee since the last annual meeting of the association.

Among the exhibits shown and manufacturers in attendance were the following:

Allis-Chalmers Company, Milwaukee, Wis. Standard railway motors, controllers, transformers, air compressors, straight and automatic air-brake equipment, photograph of installations and apparatus. M. C. Miller, C. A. Tupper, F. S. Sly, H. W. Cheney, J. W. Gardner, J. W. Murray, F. C. Randall, I. L. Dimm, J. C. Lynch, S. J. Chilton.

American Steel & Wire Company, Chicago. Electrical wires and cables, materials for fencing, rail bonds and bonding equipment. C. S. Knight, Jr., C. S. Sturdevant, George A. Cragin, R. K. Shepard, F. A. Keyes, J. H. Ashby, R. H. Ryder.

Anderson, Albert & J. M., Manufacturing Company, Boston. Remote-control switches, line material, insulators. Ernest Woltman, J. M. Anderson, W. W. Hincher, A. S. Burns, G. B. Crane, J. F. Stout.

Blake Signal & Manufacturing Company, Boston. Semaphore signals, wiring material and wiring devices, solder, staples. E. J. Burke, C. C. Blake, G. H. McFee.

Cutter Company, Philadelphia. Remote control circuit-breakers, motor-operated, electro-pneumatic, magnetic-operated; also reverse current and time-limit circuit-breakers. F. E. Beasley and T. B. Eastburn.

D. & W. Fuse Company, Providence, R. I. Inclosed fuses, cut-outs and fuse and service switch boxes, entrance, railway and transformer junction cut-outs; Deltabeston magnet wire, insulating materials for coils, completed field and armature coils; magnetic chucks, for planers, grinding and milling machines. W. S. Sisson, H. F. MacGuyer, H. P. Hinds.

Dearborn Drug & Chemical Works, Chicago. Samples of boiler compound and oils. Reception booth. G. W. Spear, H. G. McConnaughy, R. W. Carr.

Joseph Dixon Crucible Company, Jersey City, N. J. Graphite lubricants and insulating paints, brushes for railway motors and generators. J. M. Willetts, L. H. Snyder, H. W. Chase.

Electric Railway Equipment Company, Cincinnati, Ohio. Overhead line material, poles and ornamental posts. J. G. Kipp, William A. McCallum, A. L. Johnston.

General Electric Company, Schenectady, N. Y. Self-ventilating commutating-pole railway motor, with box frame motor of the light weight type; portable air compressor set for use in power houses, railway shops, etc. Sprague General Electric type M control equipment, designed for the control of four sixty horsepower motors, in operation, mounted on a rack designed to represent the bottom of a car; straight air-brake equipment, provided with air-compressor, quick-service valve, slide valve type of motorman's valve on one end and lift type of motorman's valve on the other end; controllers, commutator grooving machine, gears and pinions, recording and indicating steam flow meter in actual operation, railway supplies, miscellaneous car equipment, incuding railbonds, sherardized line material, circuit-breakers, fuse boxes, etc.; luminous arc headlight, an ozonator, in operation, for deodorizing and sterilizing the air of waiting rooms, office buildings, halls, etc.; aluminum cell lightning arresters for both 600 and 1,200-volt circuits, mercury arc rectifier, standard thirty-five kilowatt high-pressure Curtis turbine, gas electric car, oscillating type fan motor. J. G. Barry, F. H. Gale, F. E. Case, W. G. Carey, E. D. Priest, E. P. Waller, G. L. Schermerhorn, G. H. Hill, E. H. Anderson, C. E. Barry, H. N. Ransom, W. B. Potter, G. R. Parker, J. Stanton, R. E. Wooley, L. W. Shugg and C. Fair, Schenectady. H. L. Monroe, J. W. Buell and C. Dorticoes, Chicago; H. C. Marsh, Cincinnati; W. A. Woolford, Baltimore; W. J. Clark, S. W. Trawick, C. B. Keyes, and Mr. Grier, New York; G. D. Rosenthal, St. Louis; A. H. Russell, and A. V. Thompson, San Francisco; C. C. Pierce, Boston; E. H. Ginn, Atlanta; Ralph Moore and W. O. Kellogg, Philadelphia; W. H. Sigourney, New Haven.

Heany Company, New York. Heany fireproof wire, armature and field coils, Heany lamps, asbestos tapes. F. A. Duff, F. A. R. Hoffeditz, R. K. Dana.

Johns-Manville Company, H. W., New York. J-M fibre conduit for underground work; J-M Linolite system of lighting; overhead trolley and transmission line fittings; J-M Transite ebony asbestos wood and J-M Transite asbestos wood; "Noark" car fuse boxes and "Noark" N.E.C.S. protective devices, such as fuses, cutouts, service switches, etc. "Solderall" soldering paste; J-M friction tapes and splicing compounds. J. W. Perry, H. M. Slauson, Wm. D. Ligon, J. H. McManus, H. M. Voorhis, C. W. Schultz, H. M. Frantz, George A. Saylor, R. R. Braggins, Daniel Fitts, E. B. Hatch, W. R. Seigle.

Matthews & Brother, W. N. Cable clamps, lamp guards, guy clamps, trolley frog, sleet cutters, fused switch. Claude L. Matthews.

National Carbon Company, Cleveland, Ohio. Carbon products for street railway motors, stationary motors and generators, carbon brushes for miscellaneous uses and results of service tests, miscellaneous carbon products. F. D. Katy. O. T. Weaver, H. A. Worman, A. E. Carrier, B. Dye, W. B. Brady, E. H. Martindale, J. E. Hauser, D. Dickey.

Ohio Brass Company, Mansfield, Ohio. Overhead line material, bonding and rail equipment, insulators and insulating material.

Pyrene Manufacturing Company, New York. "Pyrene" fire extinguishers. H. T. Porter, H. C. Futch, G. H. Peterson, C. E. Ware.

Roeblings Sons Company, John A., Trenton, N. J. Wires and cables, bare and insulated, wire rope. M. R. Cockey, G. R. Swan, U. G. Tingley, A. V. Errickson.

Samson Cordage Works, Boston. Trolley cord, bell and register cord. F. J. Coakley, R. G. Whiting, W. G. Webb, W. G. Woodworth.

Speer Carbon Company, St. Marys, Pa. Carbon brushes. Represented by J. S. Speer, G. P. Fryling.

Standard Underground Cable Company, Pittsburg, Pa. Lead-covered and armored power cables, bare and insulated wires, Colonial copper clad wire, trolley wire, Davis open air and station terminals, manhole junction boxes, cable joining materials. A. A. Anderson, J. H. Lytle, Pittsburg; H. P. Kimball, New York; T. E. Hughes, S. S. Warner, Philadelphia; F. C. Cosby, Boston.

Western Electric Company, New York. Telephone train-dispatching equipment, selectors, dry batteries, Electrose insulating material, railway supplies. F. D. Killion, E. D. Hinman, M. A. Oberlander, J. C. Enders, R. H. Harper, R. F. Spamer, J. C. Maxon, G. K. Heyer, H. F. Miller, H. C. Owen, C. E. Robertson, A. L. Hallstrom.

Westinghouse Electric & Manufacturing Company, East Pittsburg, Pa. Railway motors, induction motors, K-type controllers and unit switch control circuit breakers, relays, overhead line material, lightning arresters and repair parts. E. M. Herr, L. A. Osborne, C. A. Terry, H. P. Davis, S. L. Nicholson, C. S. Cook, J. C. McQuiston, M. B. Lambert, J. W. Busch, A. A. Brown, E. P. Dillon, George Ewing, L. N. Reed, C. W. Register, H. C. Stier, F. N. Kollock, Thomas Cooper, S. J. Keese, T. J. McGill, C. I. Young, G. B. Griffin, C. H. Davis, H. L. Garbutt, F. C. Stieler, W. R. Scott, D. L. Beaulieu, H. C. DeCamp, F. C. Hornstein, G. S. Vail, J. E. Garrahan, T. F. McKenna, H. Beardsley, J. R. Cox, T. C. Eayrs, J. C. Kyle, J. G. Miles, H. A. Faber, N. W. Storer, C. Renshaw, J. L. Davis, R. E. Hellmund, W. Schaake, R. L. Wilson, P. H. Smith and N. S. Braden.

Westinghouse Lamp Company, Bloomfield, N. J. Railway incandescent lamps. Walter Cary, B. F. Fisher, Jr.

Westinghouse Machine Company, East Pittsburg, Pa. Turbines of the impulse reentry type. E. H. Sniffin, L. L. Brinsmade, H. P. Childs, L. C. Bullington, H. Van Blarcom.

Westinghouse Traction Brake Company, Wilmerding, Pa. Electro-pneumatic brake, A. M. M. automatic brake, S. M. E. brake equipment, electric compressor governors. John F. Miller, A. L. Humphrey, W. S. Bartholomew, E. L. Adreon, E. A. Craig, J. R. Ellicott, W. V. Turner, George H. Martin, P. H. Donovan, Arthur Johnson, C. H. Beck, S. D. Hutchins, C. J. Olmstead, C. P. Carr.

Russian Copper Production.

The Department of Mines at St. Petersburg, in reviewing the copper industry, which employs 25,000 to 30,000 miners, announces that Russia is now practically independent of foreign supplies. The apparent consumption of Russia, which at the beginning of the century was about 15,000 to 18,000 long tons, has increased this year to about 28,000 tons and is estimated for next year at about 32,000 tons.

The production for the present year has been 24,242 tons, and the figure estimated for 1912 is 26,403 tons.

A Long High-Tension Line.

What is said to be the longest high-tension line in the world was formally opened Saturday, October 9, when the Catawba River hydroelectric plant near Charlotte, N. C., was put in operation. The line extends from Durham to Charlotte, a distance of 173 miles. About 20,000 horsepower will be transmitted for use in Durham. This will be followed by still further extensions in this territory.

New York Electrical Show.

Grand Central Palace Scene of the Big Exposition, October 11-21.

The New York Electrical Show of 1911 was held at the Grand Central Palace, October 11-21. The official opening of the show was preceded by a luncheon given by the New York Edison Company to Thomas A. Edison and attended by many prominent electrical men.

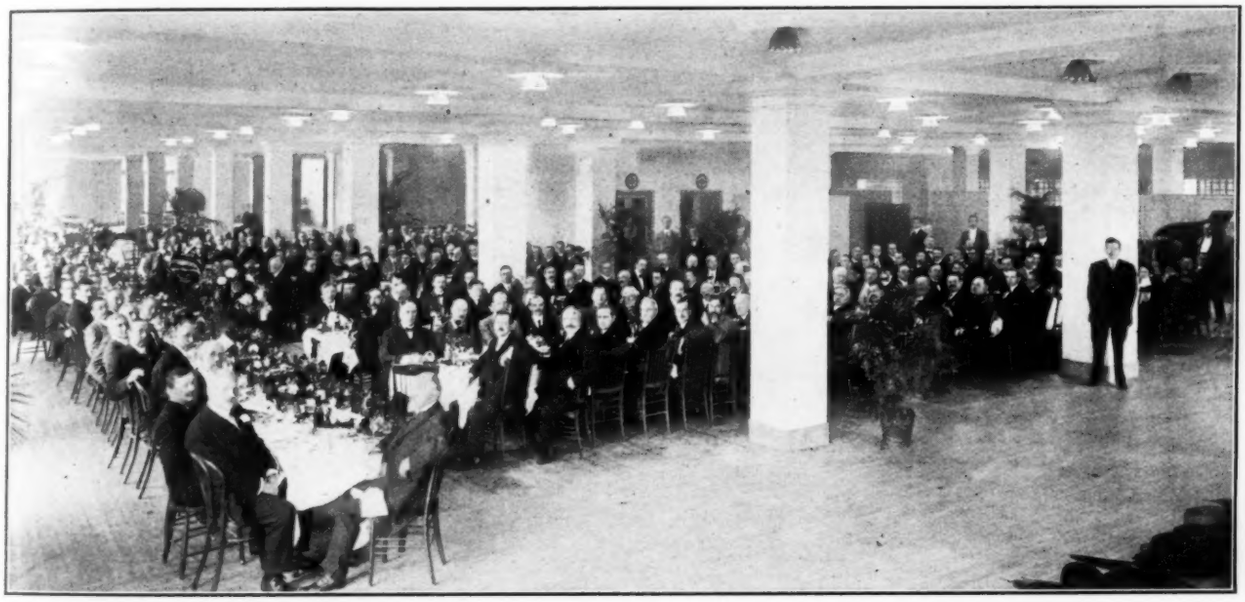
The producers and consumers of copper seized the occasion as a fit one on which to present the inventor with a gift that would express their appreciation of the part his inventions have played in the continuous stimulation of the copper industry. Their gift was a cubic foot of copper, cast with the greatest difficulty after six unsuccessful attempts. It weighs 486 pounds, and rests upon a stout pedestal. "Edison" is the simple inscription on the top of the cube. One face bore this lettering:

Edison's First Invention
Oct. 13, 1868
Output of Copper, 377,664,000 Pounds
October 13, 1910
Output of Copper, 1,910,608,000 Pounds

The story of how the copper men came to select such a token of their esteem for the inventor goes back to a dinner they gave him before he sailed for Europe on his recent trip. At that dinner the various speakers lauded Mr. Edison, and rejoiced in the vast increase in the output due to him, whereupon he remarked dryly that it was a shame he could not have a "chunk of it." So the copper men decided that he should have the largest chunk ever, and that is what he got yesterday.

The tables at the luncheon were arranged to form a giant E, with Mr. Edison sitting on the right of the toastmaster, John W. Lieb. The speakers were President Kirchoff of the American Institute of Mining Engineers, Chas. W. Price, editor of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, and George B. Cortelyou, president of the Consolidated Gas Company. T. Commerford Martin, secretary of the National Electric Light Association, presented the cube.

Among the 200 guests at the luncheon were Major Kessler of the Coast Artillery, Charles L. Booker, Nicholas F. Brady, J. Sergeant Cram, Bert Hanson, Daniel Gimbel, Prof. George F. Sever of Columbia, Park Commissioner Stover, President Alexander Humphreys of Stevens Institute, H. H. Westinghouse, George Westinghouse, Herman Ridder, S. S. McClure, and William G. McAdoo. After the luncheon the guests adjourned to the lower floors of the building to see the exposition itself.



LUNCHEON AT OPENING OF NEW YORK ELECTRICAL SHOW.

Interest was stirred by the contribution to the exposition made by the Coast Artillery division of the army. This was a detail model, showing a system of harbor defense by submarine mines and land batteries. At each end of a long glass tank was a fort, and from these the long range guns and mortars looked out over the bit of sea. The model of the disappearing gun above the bank of green excited the greatest interest. Other features include a daily newspaper, printed on a motor-driven press, the type being set upon motor-driven type-setting machines, equipped with electric-heated melting pots, and wireless station, operated by the Navy Department for news service and bulletins.

The Government exhibit includes, also, a display by the Bureau of Standards, consisting of copies of fundamental standards used in electrical and magnetic testing. Besides this, the method of making special measurements are shown. As that part of the exhibit which shows the effects of electrolytic corrosion is of considerable interest, a large number of photographs have been added to further illustrate this side of the work carried on by the Bureau of Standards.

The Department of Agriculture made

an interesting exhibit of electrical apparatus used in its work in connection with the Bureau of Plant Industry and the Bureau of Soils.

Among the historical exhibits was a model of one of the early Edison generating stations. The National Museum at Washington also contributed models and photographs of some of the earliest electrical apparatus. Among these were models of three inventions of Joseph Henry's, 1837; some of the early Morse telegraph apparatus and Farmer's electrical broiler of 1850.

Among the more comprehensive displays of industrial applications of electrical apparatus was the manufacture of vacuum bottles, showing glass-blowing, assembling, silver plating, and making the wicker containers. There was a cigarette-making plant, with a capacity of 30,000 cigarettes a day; a candy-making plant, a plant making chewing-gum, electrical blue-printing processes, paper-fastener machines, electrically operated, and a complete line of devices for office and factory use.

For the demonstration of electric automobiles a large track was laid out on the third floor of the building, with a model garage, equipped with every modern accessory for the handling of an electrical vehicle.

One of the features of the exposition was the exhibit of the Brooklyn Edison Company. This display was a strikingly artistic and attractive model home, occupying a space 134 feet long and fifteen feet deep.

The home is divided into kitchen, laundry, dining room, bedroom, parlor, reception room and porch. The aim of this exhibit was to show the way of electric housekeeping and all of the labor-saving devices available in the home wired for electricity.

Among those making individual exhibits, were the following. The data herewith also indicates, briefly, the nature of the material on display, and the representatives of the companies in attendance.

Anderson Electric Car Company, Detroit, Mich., four "Detroit" electrics; a 1912 model brougham, an electric ambulance, a 1912 roadster and the chassis for a 2,000-pound truck. W. C. Anderson, Mr. Bacon.

Babcock Electric Carriage Company, Buffalo, N. Y. Two of its electric pleasure vehicles, a town car and a roadster. R. Hawk, E. M. Osgood.

S. R. Bailey & Company, Amesbury, Mass., Electric Victoria phaeton and new roadster, both equipped with Edison storage battery.

Baker Motor Vehicle Company, Cleveland, Ohio. Heavy commercial truck and a special extension coupe. P. Dumont.

Campbell Electric Company, Lynn, Mass. Complete line of X-ray and high-frequency apparatus, portable coils, "correct" X-ray tubes, vacuum electrodes, and treatment chair. The feature of this exhibit that attracted much attention among the physicians was the latest high-frequency transformer, designed to do deep and rapid radiography. Campbell time switches, bell-ringing transformers and thermo-flashers, designed for decorative and sign flashing, were also shown. A feature in incandescent lamps in low volt tungsten, twenty-watt, forty-watt and 100-watt, was shown, with individual hanging transformers, equipped with 100-watt lamps, for interior lighting and single filament low-volt lamps for tungsten street lighting. F. R. Campbell, L. E. Gott.

Commercial Utilities Manufacturing Company. Electric time stamps and master and secondary clocks.

Consolidated Telegraph and Electrical Subway Company, New York. Model of the new subway out of the New York Edison Company's Waterside Station No. 1, showing the method of separation of cables. In reconstructing Waterside No. 1 it became necessary to transfer the cables from the First Avenue side to the Thirty-eighth Street side of the building. The new system was designed with a view toward safety and is one of the most complicated pieces of subway work in this country. The model on exhibition is the work of Mr. A. R. Rabe, of The New York Edison Company.

J. H. Day Company. Sifting, grinding and mixing machines, a dough mixer, such as is used in any large bakery or hotel. The mixer has a capacity for any quantity, from one barrel of flour up. A combination cake mixer and beating machine was also shown.

Dulles-Baldwin Electric Drill Company, New York. Electric hammers, riveters and rock drills. J. J. Shaughnessy.

Edison Storage Battery Company, Orange, N. J. Display of Mr. Edison's new storage battery. The various component parts of a cell were shown on a large board, giving one an insight of the mechanical construction of the battery. Samples of the active materials of the electrodes, the nickel hydrate and iron oxide. The various types and sizes of cells and batteries assembled in trays, from the small set used for ignition purposes, to the large A-12, of 450 ampere-hours' capacity, and a set for train lighting, were also shown. An exhibit that attracted interest was a small lighting plant, complete with gas-engine, generator, Edison battery, and switchboard. The exhibit that perhaps excited the most attention was a bumping machine, which showed how the Edison cells can withstand jolting, bumping and vibration, and still continue in operation. F. L. Dyer, W. G. Bee, F. V. McGinness, H. M. Wilson, J. F. Kelly, H. L. Davisson.

Eimer & Amend, New York. Platinum-wound and arc electric furnaces; electric drying ovens, with automatic regulator; Veit electro-analysis apparatus; Emerson fuel calorimeter; Gaede and Geryk vacuum pumps; Geissler vacuum pump and McLeod vacuum gauges; apparatus for producing static electricity under air pressure; apparatus for producing electricity from the heat supplied by gas; gas regulators with electric control device; electric centrifuges, etc. Walter R. Eimer, F. W. Shulenberger.

Electrical Testing Laboratories, New York. Paper testing methods, and the various instruments used in the physical testing of paper. Among the instruments shown were Schopper and Mullen tensile machines, folding machines for determining the durability, bursting machines, etc., together with a number of scales, micrometer gages, etc. A very interesting feature of this exhibit was the demonstration of the method of evaluating the proportions of the various kinds of fibers contained in paper samples by means of the high-power microscope. U. D. Macdonald, A. C. Kraft.

Electric Controller & Manufacturing Company, Cleveland. The E. C. & M. automatic starters and machine-tool controllers. An automatic pump starter was shown in connection with a motor-driven pump pumping water between two glass tanks. The new machine-tool controller with automatic acceleration in starting and dynamic brake for stopping was also demonstrated. F. R. Fishback, W. C. Jackson.

Electric Storage Battery Company, Philadelphia, Pa. Storage batteries of both stationary and vehicle types. Electric lighting systems for gas car illumination; ignition batteries and systems; railway car lighting equipments, and auxiliary apparatus. W. B. Bowie, F. L. Kellogg, W. O. Knudson, D. P. Orcutt.

Eureka Vibrator Company, New York. Electric vibrators.

VIEW FROM MAIN FLOOR, NEW YORK ELECTRICAL SHOW.

Federal Sign System, "Electric," Chicago. The Federal vacuum cleaner and sample signs. Demonstrations of the efficiency of the cleaner were given. This company also manufactures washing machines and kitchen cabinets, some of which were shown in connection with the model home exhibit of the Brooklyn Edison Company. H. I. Markham, L. F. Bruce, W. W. Tower, C. B. Graves, L. E. Spurrell.

General Electric Company, Schenectady, N. Y. Motors, arc lamps, theatrical lights, and a variety of household appliances. Air compressor for garage work in operation; a CVC three-horsepower motor, showing its overload characteristics, entire line of incandescent lamps, heating appliances and a motor operating a printing press. A moving picture rectifier operating theater spot and flood lamps was also installed together with a bank of dimmers connected to a set of theater-strip lights. The company's new Magnetite arc light for street lighting was one of the features of this exhibit. Lyman Clark, Mr. McDowell, Mr. Vorhees.

General Vehicle Company, New York. A 2,000-pound, standard, express type body wagon; 700-pound standard wagon, and General Electric rectifier of the commercial vehicle type. The exhibit also contained a display of cups and trophies won in endurance runs during 1910. O. L. Morgenstein.

VIEW FROM MEZZANINE FLOOR.

Gould Storage Battery Company, New York. Complete low-voltage, house-lighting plant, including battery, switchboard, generator and gas engine. High-duty standby cell for electric lighting plant, emergency capacity 20,000 amperes. Sample plates as used in United States and foreign submarine torpedo boats. Various types of vehicle batteries, assembled in trays as used in pleasure and commercial vehicles. A sample tray of cells as used in Third Avenue railroad storage battery cars. Ignition batteries, auto lighting batteries, sample grids and plates of the various types of stationary, automobile and sparking batteries. A. S. Hubbard, E. Van Wagener, J. Starkenstein, H. E. Pratt, Geo. Hayes.

Habirshaw Wire Company, New York. Various samples of rubber-covered Habirshaw wire. Samples of special rubber-covered cables this company is furnishing to the New York Edison Company for 1911 supply. Also submarine, telephone and telegraph, lighting cables. Submarine lead-incased and aerial cables. J. B. Olson, secretary; H. E. Stevens, special representative.

The Haskins Glass Company, Wheeling, W. Va. "Lucida" reflectors, "Lenticular" reflectors, and a line of cut-glass ball globes. W. Godfrey Boyd, Jr., L. C. Segal.

Holophane Company, Newark, Ohio. Prismatic glassware in appropriate shapes and ornamentation to conform with various styles of fixture design. Illuminated hemispheres, equipped with colored lamps. Replicas of medals awarded to the Holophane Company, the Buffalo Pan-American Exposition Medal and the John Scott Medal awarded by the Franklin Institute, forming part of the exhibit. Throughout the exhibit hall the illumination is dependent upon the light control and diffusion of the Holophane "Stiletto" type reflectors. V. R. Lansingh, E. W. Hyde, H. S. Whiting, F. M. Scantlebury, W. R. Timper, R. B. Grotz, G. Feher, A. Miller, E. Bradbury, A. J. Marshall.

Hughes Electric Heating Company, Chicago. Electric cook stoves. The new No. 50 electric range was especially featured and attracted much favorable notice. George A. Hughes, George Drake Smith.

Hurley Machine Company, Chicago. "Thor" washing machines. M. C. Hurley, W. J. Conlon, N. H. Haberle.

Invincible Electric Cleaner Company, New York. The Invincible vacuum cleaner.

Jefferson Glass Company, Follansbee, W. Va. "Luceo" illuminating glassware, including reflectors of various types, balls, hemispheres, ceiling bowls; many novelties in the way of ornamental and special art glassware, and a special display of units for indirect and semi-indirect systems of lighting. C. H. Blumenauer, president; M. E. Trimble, eastern sales manager; U. Skelton.

Keller Manufacturing Company, Philadelphia, Pa. The "Santo" vacuum cleaner. J. Charles Groshut.

Kinetic Engineering Company, Philadelphia, Pa. Modern organ blowers and Kinetic player-piano blower. J. G. Bierck, president; H. A. Bierck, superintendent; S. H. Ebert, New York, manager.

Kny-Sheerer Company, New York. Latest application of electricity to medical and surgical uses.

Fred Lee Company, New York. Various types of Eastern lamps, a special feature being the Eastern drawn-wire "Mazda." P. M. Dreyfuss.

Macbeth-Evans Glass Company, Pittsburg, Pa. "Alba" glass in ceiling lighting, indirect lighting units and reflectors. Also some new patterns in portable lamps. L. W. Young, F. M. Egan, G. Gernow, P. C. Egan.

Monarch Vacuum Cleaner Company, New York. Demonstration of portable vacuum cleaners. F. F. Bowie, B. B. Hertzberger, R. Campbell.

J. L. Mott Iron Works, New York. Various styles of ornamental street-lighting standards, and ornamental standards for the lighting of public buildings. Reed Adams, James N. Mackay.

Multiple Unit Electric Company, New York. Electric furnaces, suitable for heats up to 1,850 degrees Fahrenheit.

National Electric Lamp Association, Cleveland, Ohio. Three-thousand-watt, cluster, consisting of six 500-watt, all-frosted drawn-wire "Mazda" lamps, hung beneath a large steel reflector, eight feet in diameter. Other interesting displays in the booth were a small photometer comparing a carbon and "Mazda" lamp; train-lighting lamps; decorative lamps used for Christmas trees, etc.; different types of residential reflectors, which are used with "Mazda" lamps; automobile lamps, and a complete line of standard lamps, including drawn-wire "Mazdas," tantalums, Gems and carbons. F. S. Marker, G. P. Cowan, J. G. Henninger, H. H. Magdsick, H. S. Lofquist.

New York and Queens Electric Light & Power Company. The booth was fitted up as a reception room, where the company's customers were entertained.

New York Edison Company. In a series of exhibits made up of charts, diagrams, models and photographs The New York Edison Company showed its customers the methods of handling its routine business, demonstrating many of the household applications of electricity. Of special interest to consumers of current was the exhibit of the bureau which handles all kinds of bill complaints. Here were shown the various factors which affect the use of electricity and cause unusual demands. The arrangements of charts showing the comparative cost of private plant and central station current was of unusual interest to large users of electricity, while the charts showing the cost of current in New York City as compared with other large cities drew the attention of even the smallest current consumer. Other features of the exhibit were the electric dining-room, model kitchen, the company's advertising methods and the illuminating engineering display.

New York Electrical School. Collection of photographs illustrating the practical nature of its courses. The purpose of this school's exhibit at the show was to invite visitors to its building at 39 West Seventeenth street, New York City, to inspect its practical method of instruction. From their booth at the show literature descriptive of the courses and specimen printed lectures were distributed. C. V. O'Brien, G. J. Cox, and J. L. O'Connor.

Opalux Company, New York. High-efficiency glassware, shades and reflectors, including "Carnia," "Gletico," "Carrara," and "Opalux' shades and balls. G. H. McCormack, sales manager; F. McCloskey.

Otis Elevator Company, New York.—Completely equipped passenger car, with a capacity of 500 pounds. The car is of the type generally installed in private residences, and in order that the demonstration might be thorough, its builders constructed a forty-foot shaft, through which the car was operated. This height is equal to an elevator rise of five stories. All the safety devices—the ball governor, the safety plant under the car, mechanical and electrical door locks and contacts for hall doors, electrical contacts for the car gates, and the spring bumper in the pit—were shown. Martin Baldwin, G. H. Malcolm, W. A. Daly.

Phoenix Glass Company, New York. "Pheno" tungsten reflectors, globes in a variety of colored designs, table lamps with decorated domes, etc. A feature of the dis-

play was the ribbed "Pheno" ball fixture and a twenty-inch "Pheno" reflector with 500-watt lamp for large area lighting. E. H. Peck, general manager. E. F. Browne, Harry Pickhardt.

The Pyrene Manufacturing Company, New York. Demonstration showing the efficiency and insulating qualities of "Pyrene" fire-extinguishing compound. In a small glass tank immersed in the liquid compound were a bare copper conductor and incandescent lamps. Electric arcs were extinguished in the booth by means of "Pyrene." Mr. Davidson in charge of the exhibit.

Rauch & Lang Carriage Company, Cleveland. A large extension coupe shaft, trimmed in blue fancy Bedford. A Victoria was also used for demonstrating purposes.

Shapiro & Aronson, New York. "Tungstelet" shock absorbers. Electric fixtures for houses, offices or public buildings. F. S. Schwartz.

Shelton Electric Company, New York. Vibrators, hair-dryers, drink-mixers and vacuum cleaners. Percy R. Steigelman, A. H. Wood, W. G. Shelton, A. J. Crawley.

Simplex Electric Heating Company, Cambridge, Mass. New line of percolators in four different designs, and a new table range, which "cooks a whole meal from one socket." A baby range for a children's play house was also shown. This will bake, roast and boil three different articles at one time. Various other heating appliances of this company's make were also shown. Roger Williams, Clyde A. Flint.

The St. John Corporation, New York. Bell-ringing transformer and other types of low-voltage transformers, in addition to a line of lamp watt meters, and load boxes or testing sets for the central station. G. St. John, Jr., H. W. Hogeland, V. O. Sharp.

Studebaker Brothers Company, South Bend, Ind. Five-ton brewery truck, 1,000-pound market wagon with the Weisbecker body. The Studebaker pleasure car exhibit was composed of an open Victoria and an enclosed coupe. The vehicles were equipped with thirty-two cells of Exide battery, using Westinghouse motor and control. C. F. Redden, manager of Studebaker Brothers' automobile department; R. R. Clayton, J. M. Gallagher, Frank Ward, A. C. McIntosh, Col. Geo. W. Floyd.

United Electric Light and Power Company, New York. Display of modern store heating, and demonstration of practical electrical appliances. A double-deck booth in the center of the main floor was divided and arranged so that each store had its individuality and independent installation and equipment, together with a display by the various merchants. The upper section was devoted to a music and tea room, where the guests of the company were entertained and served with a light collation. Practical demonstrations of electric cooking appliances were given. The stores were a modern barber shop with all the necessary electrical devices; a well lighted grocery store; an up-to-date tailor shop with an electric sewing machine and iron; and a display by R. H. Macy & Company of their electrical household devices and lamps.

Vulcan Electric Heating Company, Buffalo, N. Y. Electric heating devices for soldering, branding, electrotype "building," wax melting, leather creasing, ironing, cooking, hair-curling and other specialties. Rex Sales Company. F. J. Holmes, H. R. Dilks, E. F. Schuerer.

John J. Waldman, New York. Wired flowers, for table decorations, minature arc-lamp for store illumination, desk clamp for office or library use, and a wire-measuring instrument which measures any weight wire from a No. 40 to a strand five-eighths of an inch in thickness.

Waverley Electric Vehicle Company, New York. Five-passenger limousine car, also a brougham, with an interior length of sixty-six inches. A chassis for a three-ton commercial truck. W. Emanuel.

Westinghouse Electric & Manufacturing Company and Westinghouse Lamp Company. Complete line of improved direct-current motors with various forms of control apparatus. These motors were recently placed on the market and this was the first public exhibition. A complete line of meters for measuring voltage, current, frequency, watt-hours, etc., and enameled wire and insulating materials. This line includes solder, paste, varnish, mica products, tape, fuller board, asbestos, in fact, any insulating substance used in the manufacture or application of electrical machinery. The Westinghouse Lamp Company had a complete display of tungsten lamps for indoor lighting, also street-series tungsten lamps. Lamps of all conditions and types were shown in full operation. The Electric Company had an extensive line of household devices, including the general utility motor, heating devices, embracing the electric iron, toaster-stove, coffee percolator, disc stove, chafing dish, air heater, luminous radiator, heating pad, dentist's sterilizer and nursery milk-warmer. W. Barnes, Jr.

Western Electrical Instrument Company, Waverly Park, Newark, N. J. New alternating-current instruments on a demonstrating switchboard, consisting of voltmeters, ammeters, power-factor meters, single-phase and polyphase watt-meters, frequency meters and synchroscopes. The exhibit includes an arrangement whereby an artificial load is applied and by means of a flasher arrangement the dead-beat action and sensibility of the pointers of the instrument is shown over the whole scale area. The company is also exhibiting for the first time the new line of small size direct-current voltmeters and ammeters. These instruments are different in size from the large standard models but are equally accurate and reliable. Chas. P. Frey.

L. A. Williamson Company, New York. "Flexilyte" portable lighting equipments. L. A. Williamson, W. B. Allen.

L. J. Wing Manufacturing Company, New York. Positive pressure blowers, ventilating fans and typhoon turbine blowers. H. S. Wheeler, E. D. Fieux, J. Dannheiser, A. E. Seelig.

The electrical press was represented by ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, *Electrical World*, *Electrocraft* and *Popular Electricity*.

An Electrically Equipped School.

The new state school for the deaf, at Indianapolis, Ind., is equipped with a complete power plant furnishing electric light to numerous school rooms and supplying power for operating all the machinery for a printing office, refrigerating and ice-making plant and an electric kitchen. The new school is one of the most completely equipped institutions in the state. S.

Exports of Copper.

Exports of copper for the week ended October 12 were 4,121 tons. The figure given since October 1 is 5,653 tons, as compared with 9,066 tons for the same period last year.

Copper Production in Tennessee.

16,837,727 pounds of copper, valued at $2,138,391, were produced in Tennessee in 1909. The production in 1910 amounted to 16,850,000 pounds.

The New Western Union Telegraph Headquarters in New York.

Mention has been made in these columns of the new telephone and telegraph headquarters building being erected in New York City by the New York Telephone Company. The *Journal of the Telegraph* gives some particulars of the telegraph facilities that will be provided in the new building, the location of which is at 18 to 26 Walker Street, a short distance west of Broadway, in the section of the city known as the wholesale dry-goods region. The plot has a frontage of 125 feet on Walker Street and a depth of 200 feet extending through to Lispenard Street. The building plans call for a structure of seventeen stories with foundations and framing for an ultimate increase to twenty-four stories.

The assignment of space gives the third, fourth, fifth and part of the sixth floors to the American Telephone & Telegraph Company for its long-distance operating rooms. The seventh, eighth, ninth and tenth floors will be used by the New York Telephone Company for offices, but no local telephone switchboards will be installed there at present. The Western Union Telegraph Company is to occupy the eleventh to the sixteenth floors, inclusive, with one-half of the seventeenth floor. The total space to be used for telegraph purposes is approximately 100,000 square feet.

The plans contemplate accommodations for 2,600 telegraph employees at one time, should the demands for operating forces require that number. It is probable that the traffic and plant departments of the Western Union will move from the present quarters at 195 Broadway to the new building about January 1, 1913, but the executive offices will remain in the old building.

The assignment of telegraph space is to be as follows: A receiving department is to be located at the easterly end of the main entrance in Walker Street and will be arranged so that the general entrance to the building will also serve the patrons of the telegraph company who desire to file telegrams there. This booth will be connected with the operating department by pneumatic tubes.

About one-half of the space on the eleventh floor is to be assigned to the female employees for rest rooms, lavatories and locker rooms, and the remaining space will be temporarily oc-

cupied by the district offices until such time as it is required for enlarging the employees' quarters. The women's rest room on this floor will be unusually elaborate and will afford every comfort. An idea may be had of the liberal plans contemplated by the size of the room. Initially, it will have a width of 35 feet and a length of 85 feet, and ultimately it will be 40 feet wide and 105 feet long. Adjoining this room will be a small room exclusively for hospital purposes. Two-thirds of the twelfth floor will be given up to the male employees for rest rooms and the remainder of the space to district offices until such time as the growth of the operating force demands the entire twelfth floor for quarters.

The thirteenth floor will be used by the plant department for the accommodation of main cross-connecting racks, switchboards, repeater tables, multiplex apparatus and a motor-generator plant. This equipment will consist of approximately forty-five sections of main line, city line and multiplex loop boards at the time of initial occupancy and of about seventy-five sections by 1930. The cross-connecting frames will accommodate approximately 20,000 and 36,000 wires for the initial and 1930 periods, respectively. The transmission and reception of telegrams will be entirely excluded from this floor and all communication between the switchboards, multiplex sets, repeaters, etc., and the operating rooms will be effected by means of a very elaborate signaling arrangement, which will permit instant communication between any and every operator's position and the switchboard and repeater attendants.

All Western Union underground cables will occupy a large cable vault in the basement, jointly with the cables of the telephone company. This vault will extend entirely through the building from Walker Street to Lispenard Street. All underground cables will be brought up in three-inch vertical tile ducts rising from the cable vault to the thirteenth floor, built in the outside wall of the building. There are to be eighty-five of these ducts exclusively for Western Union cables.

There is to be a complete arrangement of switchboards and telegraphic equipment to permit a liberal interchange of facilities with the plant of the American Telephone & Telegraph Company on other floors.

The telegraph operating department will occupy the fourteenth and fifteenth floors, and ultimately the sixteenth and seventeenth floors, it being the plan to move the other departments to other floors or to space in adjacent buildings as demands may require. The sixteenth and seventeenth floors will be constructed so as to permit conversion into operating rooms without recourse to structural changes, when desired. The operating-room equipment has not as yet been planned, but a corps of engineers is making studies to determine the most efficient methods of handling telegraphic traffic on a very large scale. It has been already decided that there must be no human element of delay between the time a telegram is received from a wire and the time it reaches the routing department. To accomplish this means automatic conveyance of telegrams from every operator's position direct to the routing table.

For the distribution of telegrams, automatic conveyors will be used to the limit of practicability, it being the plan to devise means that will not only minimize the number of handlings and that will give the most expeditious means of transit between points in the operating department, but that will also allow maximum supervision of traffic. Special tables, known as concentration tables, are being devised that will permit grouping a multiple of circuits on one table or a group of tables equipped with signal and switching devices to insure the maximum output with the minimum delay.

The operating department is to have a very extensive pneumatic-tube system connecting with many of the important branch offices. The power plant for the pneumatic tubes is to be located in the basement and will consist of the most modern type of compressors, with specially devised control, to give the maximum working economy under varying loads.

Efforts are being directed to make all equipment in the plant and operating departments of non-inflammable materials as far as practicable, and it is expected that the fire hazard from interior equipment will be almost nil.

The sixteenth floor will be occupied by the bookkeeping department until such time as it is needed as an operating room. There will be desks provided for 250 clerks, together with the filing cases for this department.

On the seventeenth floor is to be located an employees' dining room to accommodate 325 people initially and 475 ultimately. The kitchen is to be of white tile throughout and is to be equipped with the most modern cooking equipment, including about twenty-two feet of range, several large steam caldrons of fifty gallons capacity each and the latest development in electrically driven dish-washing machinery. Meals will be served to employees at nominal prices and the bill of fare will comprise a full diet such as is obtainable in any good restaurant.

In addition to the dining room, there will be located on the seventeenth floor a telephone room for the reception and delivery of telegrams by telephone. This room is to have an ultimate capacity of 100 telephone operators, it being the plan to develop this branch of the service to its maximum capabilities.

The New York Telephone Company is considering finishing up the roof of the building as a roof garden.

Hysteresis Loss of Heusler Alloys.

In an article in the *Annalen der Physik*, Steiner reports measurements made upon the hysteresis loss of Heusler alloys at different frequencies. The comparisons were made upon the basis of a constant magnetizing current. It was found that in both iron and in the alloys the hysteresis loss increased with increasing frequency up to a certain point and then decreased. The eddy currents decrease with increasing frequency. It would be expected that these losses would increase with the frequency, but a smaller area of the specimen comes into consideration at the higher frequencies and the result is a decrease. Hysteresis curves were also taken by photographic means and the results of direct measurements were substantiated in this manner. The maximum hysteresis was shown at a frequency of 4,300 cycles per second. The alloys behaved in the same manner as iron, only that the maximum induction and consequently the hysteresis were smaller. With decreasing quantities of manganese in the alloys, the hysteresis increased.

Arrangements have been completed by the Baku branch of the Imperial Russian Technical Society for the holding of an international engineering exhibition at Baku next April, to continue for six weeks.

Central-Station Practice

THE FIRST 110,000-VOLT TRANSMISSION SYSTEM IN EUROPE.

THE LAUCHHAMMER INSTALLATION NEAR DRESDEN, GERMANY.

Mention has been made in these columns of the building in Germany of an electric power-transmission system that is unique in at least two features. It is the first 110,000-volt system in Europe; although we have quite a few installations of this high voltage in America, about 66,000 has been the limit across the Atlantic. The plant is also the first one transmitting much electric power from a colliery. Further details regarding this interesting installation have now come to hand; for these we are indebted to *Electrical Engineering*, of London.

This electric power system, involving the distribution of 20,000 kilowatts, both for lighting and power, among four towns, two steelworks, and several villages, is now being completed near Dresden, and is expected to be in operation by November. Although the colliery at which the power house is situated is only about thirty miles from the extreme point of the supply area, a pressure of 110,000 volts has been adopted.

The system is being erected by an iron and steel firm, the Lauchhammer Aktiengesellschaft, the owner of a large colliery at Lauchhammer, which decided to transmit electric power from the colliery to two of its works at Gröditz and Riesa, nineteen and thirty-one miles distant, respectively. Hitherto the requirements of these works could be sufficiently well supplied from local power stations which were fired with briquets manufactured at the colliery, but the demand has now risen to 6,000 kilowatts at the Riesa works and 600 kilowatts at the Gröditz works, and arrangements have also been made to supply three municipalities that have decided to purchase power in bulk up to a maximum of 12,000 kilowatts from the Lauchhammer Aktiengesellschaft for a period of thirty years.

For the transmission of the 6,600 kilowatts for itself, the company had decided upon a pressure of 65,000 volts, but in view of the demand approaching 20,000 kilowatts in the near future, it was ultimately decided to adopt a pressure of 110,000 volts. The consulting engineer, E. G. Fischinger, in describing the system in recent issues of the *Electro-technische Zeitschrift* explains his decision as follows: The load at the steelworks will be an excessively fluctuating one, including several electrically-driven rolling mills, and in view of the large momentary drops in voltage which may therefore be anticipated, it was thought advisable to use the very high pressure stated, so as to keep the maximum voltage drop on the transmission line to five per cent (at a load of 15,000 kilowatts and a power-factor of eighty per cent). For this voltage drop a copper conductor of 0.186 square inch section would have been required if a line pressure of 65,000 volts had been used, and the cost of copper would have been too great. A section of about 0.11 square inch was thought reasonable, but this involved a pressure of 85,000 volts, for which the same special construction as would be required for 110,000-volt apparatus was necessary. In consequence, a line pressure of 110,000 volts with a copper cross-section of 0.065 square inch (seven wires stranded, each six square millimeters in section) was adopted, the extra cost of the insulators being offset by the saving in copper. Another point influencing the decision was the type of insulator to be employed, as the suspension insulator consisting of a number of small units was considered better than one large pin insulator from the point of view of reliability. One interesting result of the employment of such a high pressure with a comparatively small conductor is that the corona discharge will become so great on a rise of pressure that the latter will probably be limited to 130,000 volts. As will be mentioned later, however, the line is further protected against a rise in pressure.

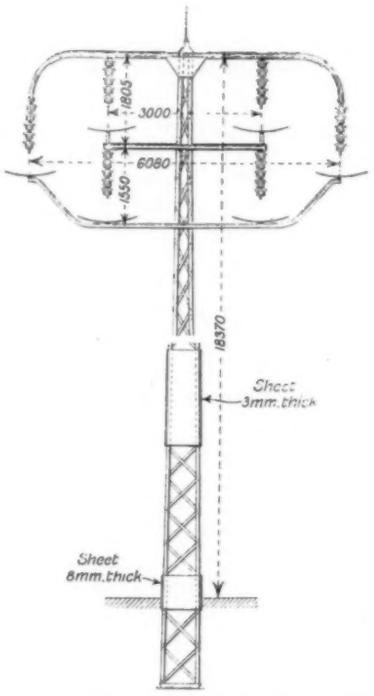


FIG. 1.—TRANSMISSION-LINE TOWER WITH INSULATORS AND GUARD BOWS.

The power station at the colliery is constructed to accommodate four 5,000-kilowatt turbo sets, of which three are already installed. Twelve out of eighteen boilers of the Lancashire type, each capable of raising 12,000 pounds of steam per hour at a pressure of 200 pounds per square inch, have also been erected. The steam is to be superheated to 750 degrees Fahrenheit. A novel feature of the steam plant is the method of removing the ashes. These fall down the inclined floors of the ash pits and flues, and are delivered into water tanks (below the surface of the water), from which they can be taken without raising any dust. On account of the difficulty of providing efficient foundations, no stacks are provided, but each group of four boilers is provided with its own economizer and a Schwabach suction-draught plant driven by a fifty-horsepower motor.

Each of the three turbo sets develops 5,000 kilowatts at 4,740 to 5,500 volts, and eighty-per-cent power-factor; two were supplied by the Allgemeine Elektricitäts Gesellschaft, and the third by the Maschinenfabrik Augsburg-Nürnberg and the Siemens-

Schuckertwerke. The guaranteed steam consumptions with 170 pounds steam pressure, 660 degrees Fahrenheit steam temperature, and ninety-one-per-cent vacuum, are 13.34 and 13.57 pounds per kilowatt-hour, respectively, at full load, and 15.87 and 15.1 pounds, respectively, at half load, inclusive of the power required for the condenser pumps. The very cold water pumped up from the mine is used for the condensers, but has to be supplemented with water obtained from two Balke cooling towers.

From the generators the current is taken through armored cables, oil circuit-breakers, and disconnecting switches to a double set of 5,000-volt busbars. At this point some 1,000 kilowatts are to be taken off for the supply of the local works and colliery, for which about 1,600 kilowatts are already supplied by an existing station. These 1,000 kilowatts are supplied through transformers arranged according to Scott connection, as the local distribution is two-phase, 1,450 volts. Four large transformers with water-cooled oil circulation and with a capacity of 5,000 kilowatts each, will be provided to raise the pressure from 5,000 to 110,000 volts for transmission. On each side of each of these transformers is an electrically operated oil switch and two sets of disconnecting switches, one to each set of busbars. The two outgoing lines are connected through oil

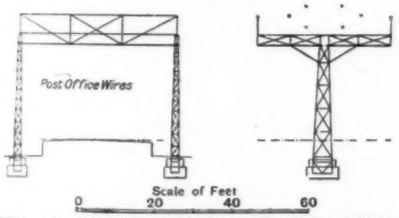


FIG. 2.—GUARD BRIDGE WHERE HIGH-TENSION LINE CROSSES ROAD AND TELEGRAPH WIRES.

switches and disconnecting switches to the two sets of 110,000-volt busbars. Instead of using flowing water resistances to lead off static charges from the lines, the high-tension windings of the potential transformers at the generating station are connected in star and the neutral point so formed is grounded. All the transformers and switchgear for this station were supplied by the Siemens-Schuckertwerke.

The transmission line consists of two three-phase circuits on a single tower line. This construction was adopted mainly on account of the difficulty of securing rights of way for two separate tower lines. All the towers are of steel lattice-girder construction, as shown in Fig. 1, and the footings are imbedded in heavy concrete bases. The conductors are spaced 5.85 feet apart only, which appears to be very close for 110,000 volts. Electrolytic hard-drawn copper is employed for the conductors. The possible saving by the use of aluminum was carefully considered, but on account of the very small proportion of the cost of the conductors to the total cost of the line, and

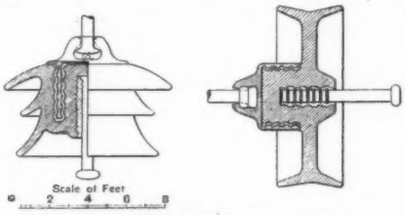


FIG. 3.—SUSPENSION AND STRAIN-INSULATOR UNITS.

the extra cost of the towers due to the greater sag, it was found that the economy effected in this case was so small as to make the use of copper, in the opinion of the engineers concerned, preferable.

A standard span of 500 feet was chosen, but on account of the difficulty of obtaining right of way in certain cases, spans of 650 feet and more were often found to be necessary. The line crosses main railway lines four times and the Elbe once. In the latter case, the span is 890 feet, requiring special towers 117 and 140 feet high on either side of the river, respectively, as the conductors had to be hung at such a height as to clear the masts and funnels of ships. Fortunately, the line crosses the river at a point between two railway bridges where the masts and funnels are lowered if necessary. After considering various different methods of crossing, namely, steel conductors, special bridge construction, etc., it was decided that the safest and best method was to use heavier copper conductors (seven wires of ten square millimeters each), with strain insulators in duplicate, and to pull up the conductors so that there would be a factor of safety of five even with maximum ice and snow load. Across the railways, a special steel guard-bridge construction is provided in accordance with the requirements of the railway authorities. Fig. 2 illustrates the steel guard structure employed where the line crosses a street and telegraph wires.

The suspension insulators consist each of five of the units illustrated at the left in Fig. 3. They were supplied by the Porzellanfabrik Kahla, Hermsdorf. The strain insulators were supplied by the Porzellanfabrik Ph. Rosenthal & Company, and consist each of six units, one of which is shown at the right in Fig. 3. Strain insulators are used at the railway and river crossings, and also at all towers where the conductors deviate more than five degrees from a straight line. The conductors are also pulled up to the towers by strain insulators at regular intervals along the line—about every mile—where the conductors are transposed. In all, the conductors of each circuit are transposed over thirty times, and by this means not only are inductive effects on neighboring telephone lines practically eliminated, but also the mutual induction and electrostatic influence of the two parallel circuits reduced to a negligible quantity. The particular arrangement of the conductors to effect this was especially devised by Professor Ulbricht. It will be noticed that, by the bow-shaped form of the upper cross-arm, the conductors are hung symmetrically, and inequality in the self-induction of the phases thus prevented.

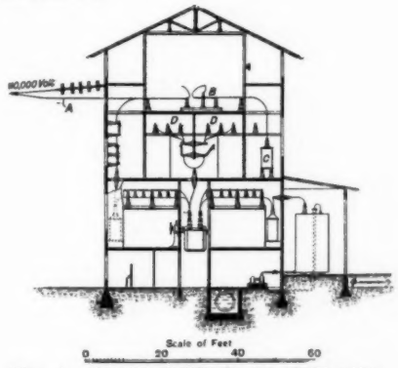


FIG. 4.—CROSS SECTION OF THE SUB-STATION AT GRÖDITZ.

The complete set of six conductors is protected from direct lightning strokes by a single steel cable of 0.0775 square inch in section, which also serves to interconnect and ground the towers, and each tower has a special ground plate buried below the concrete foundation. To insure the grounding of the conductor in the event of a break, steel bows are attached to the arm below the conductor, as is shown in Fig. 1. No tree was allowed to remain near the line which could touch it on falling.

The overhead lines terminate at the

high-tension busbars in the first of the two main substations, namely, that at Grödiz, a section through which is shown in Fig. 4. The conductors are pulled up to the wall of the substation by means of strain insulators, and connecting wires *A* lead in through the center of plate-glass panels. Protection against direct lightning stroke or excess pressure is given by the horn-gaps *B* and electrolytic lightning arresters *C*. The duplicate busbars are shown at *D*. The section also shows the choke coil to prevent pressure surges from reaching the apparatus, a 110,000-volt oil switch, and the oil-cooled transformers.

The total capacity of the Gröditz substation is about 13,000 kilovolt-amperes. The wide spacing of the conductors and the size of the apparatus necessitates a large building, in this case 155 feet long, 85 feet wide, and 72 feet high. From this station the overhead lines run again in duplicate to a similar but larger station at Riesa, with a capacity of 19,000 kilovolt-amperes.

A 60,000-volt overhead ring main over seventy-five miles long, owned by the municipalities, runs through their district, and is fed at each end by a set of 7,000-kilovolt-ampere transformers in each of the two main substations. There are seven small substations on this ring main feeding current at 15,000 volts to local substations, which distribute at 220 volts. The power taken by the municipalities is measured at each main substation by Aron meters with maximum-demand attachments.

The pressure regulation of the high-tension system is effected by maintaining automatically a constant pressure of 100,000 volts at a point between the two main substations by means of Tirrill regulators in the generating station actuated by series current transformers.

In order that there shall be a means of regulating the pressure on the distributing networks, the municipalities have provided series regulating transformers in each of the seven 60,000 15,000-volt substations on the 15,000-volt side of the main transformers, and these can produce a variation of 750 volts in either direction. The transformers and switchgear in the substations at Riesa and Gröditz were supplied by the Allgemeine Elektricitäts Gesellschaft.

A Curious Crankshaft Breakdown.

The designers and erectors of electric power-plant machinery sometimes come across unexpected difficulties which entirely upset their calculations and for a time are quite baffling. Even in the most standardized schemes it is nearly always the case that something will go wrong and will have to be put right by the contractors before the plant is taken over by the purchaser. An interesting case illustrates this. A small alternating-current power house had been erected, the alternators being direct-coupled to horizontal medium-speed steam engines; the coupling was at one end of the crankshaft, and a small flywheel at the other. It was expected that the flywheel plus the weight of the rotating part of the alternator (the field) would be sufficient to reduce the cyclic variation of the sets sufficiently to give smooth parallel running. Curiously enough, however, after the station had been put into parallel running, there was not a great lapse of time before one of the crankshafts broke right across, and the indications of the fracture were those of severe torsional stresses. A new shaft was put in, but failed some little time afterwards, and a third shaft broke in exactly the same way. The matter was then very carefully looked into, and it was found that the engine builder, who had originally standardized his engines with wrought-iron crankshafts had, afterwards, followed modern practice by using mild steel. This was, of course, quite in order, but the point had been overlooked that mild steel is far more subject to "fatigue" than wrought iron. The continual torsional effects produced by the parallel running of the alternators and the consequent variations of effort on the crankshaft between the flywheel end and the coupling end had produced a certain amount of crystalization in the material, finally resulting in a fracture. We have often pointed out that the flywheel should invariably be placed between the engine and the generator, and the object lesson conveyed by this example may serve as a warning to those engine builders who persist in following the practice which we have condemned.—*The Electrical Review* (London).

Corrosion of Steam Piping by Soda.

F. Westhoff states in *Stahl und Eisen* that in a boiler plant working partly with saturated and partly with superheated steam, the wrought-iron pipes and cast-iron valves of the superheated-steam line were badly attacked after four years' service, whereas the saturated-steam line was in excellent condition. Appearances suggested local solvent action. On close examination a whitish matter was found at the corroded places, which, on chemical analysis, proved to be in part at least sodium carbonate. Soda was used for softening the feed, and it seemed that the amount used was rather excessive; one and one-half days after blowing down the boilers the boiler water showed 12.4 grains of soda per gallon. The investigator concluded that soda particles were carried along with the steam, and that in the superheated-steam line they could deposit, while with saturated steam the condensation flow prevented deposits. He concludes that this deposited soda corroded the iron.

Character of Ash in Coal More Important Than Its Quantity.

It is not easy to determine the effect of small variations in the percentage of ash on the results obtained under the boiler. In this respect the character of the ash is of more importance than the quantity, say D. T. Randall and Perry Barker, of Boston, in a recent communication. Clinkers and ash reduce the efficiency and capacity by making it necessary to hold the doors open longer in cleaning the fire; and in case the ash fuses and runs onto the grate bars, the air is shut out, the grates may be burned, and the results affected by the imperfect air supply. A large percentage of ash tends to make the distribution of air through the fuel bed uneven requiring a much larger air supply than is necessary for other coals. Large quantities of ash also cause a loss of unburned coal due to the poking and frequent cleaning of the fire. When the coal contains a high percentage of ash, the labor of feeding the furnace with the extra quantity of fuel, the cleaning of the fires, and the handling of the ash, may make it necessary to employ extra help in the boiler room. There is also an additional expense in hauling the refuse away from the plant. The extra quantity of ash may make it impossible to burn a sufficient quantity of coal upon the grate surfaces provided, requiring the operation of an additional boiler.

Commercial Practice—Management, Rates, New Business.

Slogan Sign for St. Louis.

Several months ago a public contest was held in St. Louis for the purpose of selecting a city slogan which could be used for advertising purposes. After approximately 85,000 slogans were examined, a committee composed of seventeen prominent business men selected the phrase: "St. Louis Has the Goods."

This slogan has been used to advertise the city in a variety of ways, but not in any other manner as effectively as through the use of a flashing electric sign. The Union Electric Light & Power Company donated to the city this sign which stands on the roof of the old Armory Building in St. Louis, at Seventeenth and Pine Streets. The letters in the sign are four feet high, stand fifteen feet above the building roof and occupy a space eighty feet long. With the height of the building the sign stands against the dark sky 150 feet in the air, and its message is flashed so that it may be read from all incoming and outgoing trains, as well as from a very long distance to the South. The words in the sign are flashed on separately, then the complete slogan is left for a moment or two, and the process repeated.

The mayor, members of the municipal assembly, officers of the civic and commercial organizations and members of the slogan committee were present when the sign was presented to the city and first flashed its message to the public. The Union Company thus took advantage of an excellent opportunity to place itself in favor with the city officials and civic organizations.

OUTLINE LIGHTING OF UNION ELECTRIC LIGHT & POWER COMPANY'S BUILDING.

Office Building of the Union Electric Light & Power Company, St. Louis.

The accompanying illustration shows the decorative lighting which has recently been installed on the new office building of the Union Electric Light & Power Company, St. Louis, Mo. This new building is located at Twelfth and Locust Streets, just two blocks from the former quarters of the company.

As foremost among the boosters for St. Louis, the Union Electric Light & Power Company felt that it should not only secure quarters of a sufficient size to accommodate its rapidly growing business, but should erect a building that would prove an ornament to the city and be a model, as regards lighting, for other office buildings.

In accordance with these ideas the building is an attractive, modern fireproof structure and the interior lighting is in accordance with the latest practice in illuminating engineering. The outline lighting just completed adds to the attractiveness of the building at night and this is further augmented by the ten flaming-arc lamps suspended from the walls at the third-story level.

As regards the layout of the building, an ingenious plan was worked out for the display room. As will be noted a portion of the building is occupied by a theater. That portion to the right of the lobby, on the first floor, is utilized as a display room with a passage way to the main theater lobby. The company has fitted this display room in an attractive manner, providing accommodations for patrons of the theater and inviting them to utilize it as a waiting room. Attendants are constantly on hand to demonstrate the apparatus on display and frequently light refreshments, prepared in electrical utensils, are served.

People's Electrical Page.

Co-operative advertising in the form of a so-called electrical page published weekly in a daily newspaper and containing an assortment of electrical advertisements, mention of which has been made in previous issues, has been instituted in Boston. The Boston *Sunday Post* for September 3 contains the first electrical page to be published in that city. The news features are timely and of interest and the advertisers have apparently entered into the spirit of the proposition.

The idea of co-operative advertising of this nature was inagurated in Cleveland, with great success.

Increasing Central-Station Business in Wichita, Kan.

The Kansas Gas & Electric Company, Wichita, Kan., has made an enviable record, as regards new business, during the past year, the output of the company being practically doubled. From a recent count, it is estimated that there are connected to the company's circuits over 5,000 electric fans, 2,500 electric irons and 200 washing machines. Great increases have also been made in industrial motor applications, this load representing over 5,500 horsepower.

As regards street lighting, the electric company is completing negotiations with the municipal authorities whereby the 140 antiquated arc lights, at present installed in the business district, will be superseded by 450 modern-type arcs suspended from ornamental iron poles spaced 100 feet apart. This lighting will be further augmented by tungsten lighting in the residence districts.

Electric Lighting and Illuminating Engineering

The Artificial Lighting of Factories.

At the monthly meeting of the American Society of Mechanical Engineers, held in New York City on October 9 in the Engineering Societies Building, a paper was read by L. P. Alford and H. C. Farrell on "Factory Construction and Arrangement," dealing especially with the plant of the United Shoe Machinery Company, at Beverly, Mass. The discussion of this paper was confined to the subjects of lighting, manufacturing plant and shop floors. The portion of the paper relating to the lighting and power equipment is as follows:

The current generated at the power house is 575-volt, three-phase, sixty-cycle, distributed without transformation by the power circuits to 500-volt induction motors and transformed at a number of distributing centers to 100 volts for the lighting system. Three lighting systems are used; these are designated day, public and machine-tool circuits. The primaries of all are independently connected by switches in the power house.

The day circuits furnish light for the offices, drafting rooms, storage areas and wherever may be necessary in the daytime, and each room is provided with its own switch control so that artificial light may be had at any time. The public circuits furnish light for the toilet, wash and locker rooms in the toilet-room wings, for all entrances and exits to the plant, for the cross corridors connecting the main buildings and for the longitudinal central passageways on all machine-shop floors. These circuits are controlled entirely from the power house. The machine-tool circuits feed individual lights for machine tools and manufacturing operations. These circuits are controlled on each floor and for comparatively short lengths, averaging about 200 feet.

In operation, the public-circuit switches in the power house are closed twenty minutes before the time of beginning work, thus furnishing light for the entrance of employees to the plant. They remain in use until there is sufficient daylight to permit unhindered movement throughout the passageways and aisles. These circuits are again brought into use in the afternoon shortly before quitting time, and remain in for a sufficient length of time to permit every one to leave the plant. The machine-tool circuit is thrown in at starting time, pulled at noon, thrown in at 12:55 p. m. and pulled again at 5 p. m. The day-circuit swtiches are kept in at all times, connecting the lines with the generators when they are running and with an outside source of current supply when they are shut down. Thus the offices, drawing rooms, and a limited number of lights required for the night watchmen, are available at all times.

In the original plant the day circuits and the machine-tool circuits fed nothing but incandescent lamps mainly of sixteen candlepower. The public circuit feeds incandescent lamps in the toilet-room wing, a limited number of incandescents along the main aisles and passageways and 7.5-ampere inclosed arcs at the junction points of the longitudinal passageways of the main buildings and cross passageways connecting these buildings through the wings.

The lighting systems at present are undergoing a modification, not as regards the original circuits themselves or their control, but as regards the lighting units. The offices and drafting rooms have been equipped with mercury-vapor lamps of 150 and 300-candlepower sizes and these have been found quite satisfactory for this service with the possible exception of some slight difficulty in determining the colors of cards and inks in some of the office work. At the present time, one section of a miller department is equipped with these lamps as an experiment, which, if satisfactory, will result in their use to the exclusion of incandescents in the manufacturing departments. In case it is deemed inadvisable to use such lamps for manufacturing processes, they will, however, replace the arcs on the public circuits and in departments that require nothing but general illumination.

The lighting factors of the original installations were as follows: For offices and drafting rooms, 0.5 candlepower per square foot of floor area; for manufacturing department, 0.3 candlepower per square foot of area; and for the public circuits, 1 candlepower for each twenty-nine square feet of floor area. This factor is not as satisfactory as it should be because the ceilings of some of the rooms are crossed by a number of sheet-metal ventilating ducts, so arranged that a larger number of lamps would have to be installed, to prevent objectionable shadows, than would otherwise have been necessary. The installation of the mercury-vapor arc lamps over the milling-machine area provides ninety watts for each ten square feet of floor area. The switch control for these mercury-vapor lamps is by twos in series lengthwise of the room.

The discussion on shop lighting was of a general character; it was opened by G. H. Stickney, of the General Electric Company. According to him, localized and general illumination mark the two extremes of lighting practice. Up to a short time ago, practically all industrial lighting was accomplished with the carbon-filament incandescent lamp for localized illumination, and with the arc lamp for general illumination. The high efficiency of the arc lamp gave it the preference over the incandescent for this purpose, but in many cases combined installations have been made. The tungsten-filament lamp has provided a range of efficient units in the gap between the arc and incandescent lamp. There are, therefore, now four classes of practice in shop lighting, viz.: localized illumination with small units; general illumination with large units; combined localized and general illumination with large and small units; localized-general illumination with units of intermediate size.

Localized illumination usually implies a carbon-filament incandescent lamp, hung over a machine or bench, mounted on a bracket or used as a portable. The lamp is under the control of the workman who places it so as to direct the light where needed. The illuminated area is relatively small and the intensity falls off rapidly from the point of maximum illumination. Localized illumination has been largely superseded by localized-general illumination. For example, illumination of deep borings, molds, under or inside of machines, etc.; of straightening or inspecting processes where the image or reflection of the light is specially employed; illumination of very fine work, such as small screw-thread cutting; machine sewing on dark goods where intense illumination is required over small areas. It is most economical where the illuminated surfaces are relatively small and widely separated.

General illumination attempts to provide an approximately even intensity of illumination throughout a workroom, but this ideal is seldom realized, except possibly when the lamps are hung at a considerable height. The lamps are usually spaced equally throughout a room, independent of the location of the machinery, and the most efficient illuminants are available. Fewer outlets being required, the initial wiring cost and maintenance expense are relatively low. Where work is concentrated, requiring a particular intensity over a large portion of the floor area, general illumination will usually cost less than localized lighting. It is best adapted to high shops, especially where craneways require the location of the lighting units along the sides of the room or above the crane. It is desirable on account of safety where large, powerful, moving machinery is used, and is commonly employed in rolling mills, large machine shops, erecting bays and similar places.

Combined general and localized illumination is adapted to shops in which a low or moderate intensity will answer most requirements, higher intensity being required at but a few localized points. For example, a group of automatic screw machines requires but moderate general illumination while in operation, but intense illumination is required at a particular point when one of the machines is being set up or adjusted. For work of this character in which one workman attends a number of machines, it is good practice to provide him with a lamp and short extension, arranging the wiring so that the extension can be plugged in at various points near the machine.

The term localized-general illumination is applied to the practice of producing general illumination by means of regularly arranged units, but with reference to the machinery or processes so as to provide a higher intensity of illumination at important points than elsewhere. Units are located also to give suitable direction to the strongest light on a certain machine, to avoid shadows and reflections. This practice has followed the development of the tungsten lamp, which gave a series of efficient units through a range of size for which no provision had previously been made. Localized-general illumination is now largely used for looms, lathes, and other machinery, where the size and spacing of the machines is such as to permit uniform spacing of lamps. By varying the height, spacing and size of unit as well as the type of reflector, practically any character of distribution of illumination of suitable intensity can be obtained.

Localized-general illumination is distinct from localized illumination in that the lamps are located higher and are not usually controlled by the individual workman, and from general illumination in that the points of maximum intensity are located to suit the arrangement of machinery and other processes.

In discussing the same subject C. E. Clewell, of the Westinghouse Electric & Manufacturing Company, said that shop lighting is one of the indirect items leading to greater efficiency of the worker. It may be considered from the two standpoints of a condition for clear vision and as one of the factors in the shops which makes for the comfort, contentment and working efficiency of the employees. Previous to the past decade, the lamps available were limited practically to the carbon-filament lamp of low candlepower and the arc lamp of high candlepower. The introduction of Nernst, mercury-vapor, Moore-tube, metallized-filament, tantalum and tungsten lamps, has made available lamps of almost every candlepower, ranging from small to very high values. There is accordingly no need for a glaring arc lamp in locations where the ceiling height is moderate and which are far easier and better lighted by a medium-sized lamp.

The general interest taken in the subject of illumination, has been partly brought about by the modern efficiency movement, which has looked to the elimination of all causes limiting the attainment of high efficiency. Almost all shops in the past have been provided with inferior lighting conditions, largely due to the lack of more suitable lamps when the installation was first made and also because the attitude toward lighting in the past has been practically one of expense *per se*. The economic effect on the workman has been generally ignored. With the realization of the importance of improved lighting conditions, we find that lighting facilities, which a couple of years ago were considered extravagant are today not only tolerated by the practical shop man, but demanded as essential to his best interests. This has been followed by a change in the standard of quantity of light considered necessary for various purposes throughout the shop, which, coupled with the many new lamps of higher efficiency, has produced a two-fold condition of development during the past year or two that is today beginning to settle to a state of equilibrium in the matter of light quantities considered necessary and in the matter of the type of lamp best suited to the various classes of work.

There are three general methods by which artificial light may be furnished, viz., the units may be used as individual lamps close to the work, one lamp being provided for each machine; the lamps may be mounted above the heads of the workman, thus providing distributed light units over the entire floor space, or a combination of the two foregoing methods may be employed; it is best, where possible, to eliminate drop lamps and install enough lamps mounted high and out of the ordinary field of vision to light the place properly. The reasons for preference being given to the overhead system are as follows: With the overhead system, the entire floor space is lighted so that work can be performed at any point; in most cases some light from overhead lamps is necessary even when drop lamps are used; a small increase in the number of overhead lamps may render the drop lamps unnecessary, thus saving the maintenance on drop cords, which is apt to be high when compared with that of lamps mounted out of reach; by mounting the lamps at the proper height, selecting the proper size and adopting reflectors or globes, glare or dazzling effects may be avoided; when a drop lamp is placed close to the work, the small space which it lights is usually very intense; in the absence of overhead lamps, the surroundings will be considerably darker than this spot and the eye is fatigued if it must continually travel from the bright spot to the darker surroundings, not to speak of the added difficulty of finding tools and material in the darker zone; the overhead system is more economical, more pleasing and neater in appearance than where drop cords are used.

While the preceding features argue in favor of the overhead system, drop lamps are essential in some cases, such as in die making, in which edges and openings must be exact, and also with milling machines where the work is often of such a nature that the workman must look into deep openings or up from below.

In one large shop the upkeep on extension lines was about twenty-five cents per month each or one cent per day. The man using one of these extension lines, may possibly earn from two to three dollars per day in the operation of the machine, that is, two to three minutes is equivalent in wages to one cent. Calculated on a basis of wages alone, two to three minutes will cover the cost of extension-line maintenance and there are many cases where far more than this amount of time will be saved by providing a drop cord with an individual lamp for the work.

The avoidance of eye strain and the promotion of economy in operation by the use of high-efficiency lamps with low maintenance costs, and at the same time the location of the lamps so that they are easily accessible for renewals and repairs are among the important items of successful shop lighting. In design, attention must be given to the

intensity of the light, to its uniformity and to the reflectors to be used. These last are now designed to distribute the light evenly over the floor space, a desirable feature in maufacturing locations. Other important items are the elimination of drop lamps in all but exceptional cases, the avoidance of bright light shining from the lamp into the eye, the use of lamps of such sizes consistent with the ceiling height, the consideration of the type of reflector holder so that the filament of an incandescent lamp in it shall be at the particular point necessary to attain the best results. The light thrown vertically downward by the lamp and reflector is often considered to be the most important component of the light. The sides of machines and machine tools, however, in many instances require strong light and may be even more important than the horizontal surfaces involved. Higher values of the side light have been secured in some cases with the overhead system by lowering the lamp somewhat and using a reflector of wide distributing type. The idea that the excellence of the light is in proportion to the quantity is a mistake. Too much light may even be more harmful to the eye than too little. None the less troublesome, however, is the effect produced by lamps spaced too far apart. This also produces eye strain and renders good work impossible.

The wiring should be so arranged that the lamps may be controlled economically by fairly numerous switches, in general lines parallel to the windows and skylights, and also so that not too large an area of floor space shall be lighted by the lamps of each circuit. Certain lamps when not required may thus be turned off.

The questions of color, quantity, diffusion, shadows, distribution and the like are important and should be considered in planning the lighting for a new location in the shop. Illumination results depend very largely on the surroundings, the color of the walls and ceiling, the dust and dirt in the air, the voltage conditions and type of reflector; that is, whether the light from each lamp is concentrated or distributed over a large area.

A maintenance department is an excellent feature of a well-equipped shop. The lamp should be renewed as soon as burned out or trimmed when necessary, and the reflectors and globes cleaned at sufficiently short intervals to insure an average condition of high efficiency. Losses of light as great as fifty per cent in the worst cases have been recorded due to accumulations of grease and dirt on glass reflectors. As the cost of cleaning is small when compared to the loss of light, interpreted in money values, this item should not be neglected.

The necessity for good lighting is so apparent that the enumeration of some of the effects may seem commonplace. These effects, however, are so significant in their relation to shop management that they are worth mentioning.

Decrease in the cost of operation and maintenance of the lighting system, or increase in the quantity and quality of the lighting for the same cost; greater accuracy in workmanship with consequent lessening of the defective work; increase in production with accompanying decrease in cost; reduced liability of accidents; lessening of eye strain; more cheerful surroundings; contentment of the workmen, insufficient light breeding discontent as well as poor work; order and neatness in the care of the shop, and a pride in maintaining it in such condition; supervision of the men made easier. This is especially the case in locations which are crowded with machinery and belting.

To the manager, the highest consideration is the money value of the light due to the superior workmanship and greater output. As illustrating the small differences between good and inferior lighting consider the following hypothetical case. Making certain assumptions in the case of tungsten lighting as to energy cost, life of lamp, cleaning, interest, depreciation, etc., the annual operation and maintenance cost for a typical factory bay 16 by 40 feet may be taken as $50. If the wages of the five men employed in it equal twenty-five cents per hour each, the gross wages of the five men per annum may equal $3,500. Adding to this the cost of superintendence and indirect expense, the gross cost of such a bay may equal $5,000 to $7,000. The lighting will then cost 0.7 to 1.0 per cent of the wages, or the equivalent of less than four to six minutes per day. Poor lighting will presumably cost at least one-half of this amount say two to three minutes per day. If therefore good light enables a man to do more and better work to the extent of two or three minutes per day, the installation of good lighting will pay for the difference between poor and good systems.

Electric Street Lighting to Replace Gas in Another Section of London.

The Electric Light Committee of the Borough Council of Shoreditch, London, England, has made an important recommendation that electricity shall be substituted for gas in all the streets in the borough north of Old Street. At a recent meeting the Council adopted the plan. The number of burners now illuminated by gas in this district is 1,055. About fourteen miles of cables will be required in the 160 streets affected by the proposed change, says *Electrical Engineering*. Mains of sufficient size to meet any reasonable private demand, in addition to the street-lighting load, will be laid at an approximate cost of $41,925. The cost of converting the existing posts for electric light is estimated at $3,325. The annual saving over gas street lighting is estimated to be $1,150. The gas mantle burners will be replaced by 50 and 100-candlepower tungsten incandescent lamps.

Power Equivalent to One Candlepower at Different Wave-Lengths.

In a paper read before the French Academy of Sciences, Buisson and Fabry report on experiments in which they have compared the intensity in energy units of the visible violet, green and yellow rays of a quartz mercury-vapor lamp measured with a bolometer with the light intensity of a Hefner lamp measured with a Lummer photometer. The quartz lamp was six centimeters long and was operated at twenty-seven volts and 3.5 amperes. The candlepower in a direction normal to the length of the tube was 2.1 for the violet ray, 41.5 for the green, and 17 for the two yellow rays. With the bolometer at a distance of one meter from the lamp the power in watts per square centimeter was 0.513 for the violet ray, 0.583 for the green and 0.285 for the yellow.

According to these significant figures the watts per mean spherical candlepower are for the violet ray 0.31, for the green 0.018, and for the yellow 0.021. Hence a lamp which radiated all its energy without loss in green light would give fifty-five candles per watt. The values found by direct methods for this quantity, which is sometimes called the mechanical equivalent of light, were seventeen candles per watt by Drysdale, and seventy-two candles per watt by Hyde.

New Electrical and Mechanical Apparatus and Appliances

New Unity-Power-Factor Single-Phase Motor.

The Wagner Electric Manufacturing Company, St. Louis, Mo., has developed a new single-phase constant-speed motor, the design of which embodies many interesting features. Briefly described the new motor is as follows: The stator, or field construction, corresponds closely to that heretofore employed, with the exception that two windings are used instead of one. Referring to Fig. 1, the main stator winding 1 produces the initial field magnetization as heretofore; the auxiliary winding 2 controls the power-factor or "compensates" the motor.

The main structural departure is in the rotor, the construction of which is more clearly indicated in Fig. 2. Here again two windings are employed. The main or principal winding 4 is of the usual well known squirrel-cage type and occupies the bottom of the rotor slots. The second or auxiliary winding 3 is of the usual commuted type, is connected to a standard form of horizontal commutator and occupies the upper portion of the rotor slots. Between the two is placed a magnetic separator in the form of a rolled-steel bar. Two sets of brushes are provided, as indicated in the diagram of connections shown in Fig. 1. The main pair of brushes 5-6 is placed in the axis of the main stator winding 1 and is short-circuited. The auxiliary pair of brushes 7-8 is placed at right angles to the axis of the main stator winding and is connected in series with it at starting. The auxiliary stator winding 2 is permanently connected to one auxiliary brush 7, and is adapted to be connected to the other auxiliary brush 8 by means of the switch 9.

The purpose of the peculiar rotor construction illustrated in Fig. 2 and of the brush arrangement and connections shown in Fig. 1 is to accentuate, at starting, the effect of the squirrel cage along the axis 5-6 of the main stator winding 1, while suppressing it as far as possible along the axis 7-8 at right angles to 1. The magnetic separator placed above the squirrel-cage winding 4 tends to suppress the effect of that winding along all axes, by making said winding less responsive to outside in-

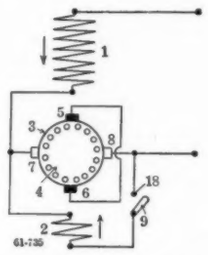


FIG. 1.—STATOR WINDINGS.

ductive effects. But the influence of said separator is nullified along the axis of the main stator winding by the presence of the short-circuited brushes 5-6, while no means are provided for nulli-

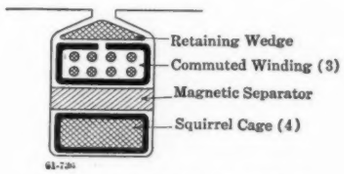


FIG. 2.—ONE SLOT OF ROTOR.

fying its effects along the axis at right angles to that of the main stator winding. Thus the main stator winding 1 will be able to induce heavy currents in both rotor windings because of the

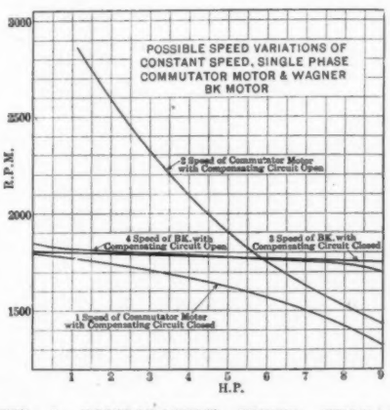

POSSIBLE SPEED VARIATIONS OF CONSTANT SPEED, SINGLE PHASE COMMUTATOR MOTOR & WAGNER BK MOTOR
R.P.M.
3000
2500
2000
1500
3 Speed of Commutator Motor with Compensating Circuit Open
4 Speed of BK. with Compensating Circuit Open
3 Speed of BK. with Compensating Circuit Closed
1 Speed of Commutator Motor with Compensating Circuit Closed
1 2 3 4 5 6 7 8 9
H.P.

FIG. 3.—COMPARATIVE SPEED CHARACTERISTICS.

short-circuited brushes in the axis 5-6, and in spite of the magnetic separator, while the rotor winding 3, connected in series with 1, will not be able to produce heavy currents in the squirrel-cage winding 4 along the axis 7-8 because of the magnetic separator between 3 and 4 which shunts or sidetracks the inducing magnetic flux.

The mode of operation may be generally described as follows: At starting, switch 9 of Fig. 1 is open, the commuted winding 3 along the axis 7-8 being connected in series with the main stator winding 1 and across the mains. The winding 1 induces a large current in the rotor windings 3 and 4 along the axis 5-6, and the winding 3 produces a large flux along the axis 7-8. The rotor currents in the main axis co-acting with the flux threading the rotor along the auxiliary axis yield the greater part of the starting torque. As the motor speeds up, the squirrel cage gradually assumes those functions which it performs in the ordinary single-phase squirrel-cage motor, developing a magnetic field of its own along the axis 7-8 and a correspondingly powerful torque, which increases very rapidly as synchronism is approached, but falls suddenly to zero at or near actual synchronism. It is known that the magnetizing currents circulating in the bars of the squirrel cage of a single-phase motor have, at synchronism, double the frequency of the stator currents; the fluxes they produce must therefore also be of double frequency. Now, the magnetic separator is made of solid steel, and, while this separator forms a sufficiently effective shunt for the fluxes of line frequency induced from the stator, it is quite ineffective as a shunt for the double-frequency fluxes produced by the rotor. As far as the squirrel cage is concerned, the effect of this magnetic separator diminishes with increasing speed, and at synchronism the machine operates practically in the same manner as if said magnetic separator did not exist at all.

The speed torque curve of this machine is therefore mainly composed of two torques. The one is due to the interaction of the commuted and the squirrel-cage windings in the main axis with the commuted winding in the auxiliary axis; this torque is large at starting

and diminishes with increasing speed. The other is due to the inter-action of the main stator winding and the squirrel-cage winding; this torque is nil at starting, but increases very rapidly beyond a certain speed.

In mechanical structure the new motor is remarkably simple. It gives little or no outward evidence of unique construction, and internally there are no mechanical features complicating the motor in any degree. A small automatic centrifugal switch provided on the outer extension of the rotor shaft is used in place of the switch 9 of Fig. 1; it serves to connect the compensating winding 2 to the brushes 7-8 after a sufficient speed has been reached. This automatic switch is not essential to the operation of the motor in any respect, but does serve the purpose of improving the power-factor and of slightly improving the efficiency in the running condition.

The employment of the squirrel cage secures a remarkably constant speed at all loads, as indicated by curve 3 of Fig. 3. This curve 3 should be compared with curve 1 of the same illustration. Curve 1 shows the speed variation of a known commutator motor, of corresponding capacity, in which the commutator carries the whole working and exciting currents and which has

curves of a type BK five-horsepower, sixty-cycle, four-pole motor are shown in Fig. 4. If, while the motor is running, all brushes are entirely removed from the commutator, the machine will continue to carry its load, operating in the manner indicated by the curves shown in Fig. 5.

The starting torque characteristics of this BK type motor, as compared with

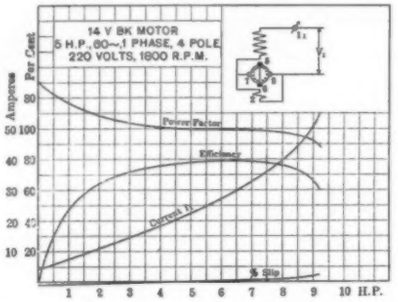


FIG. 4.—NORMAL RUNNING CURVES OF BK MOTOR.

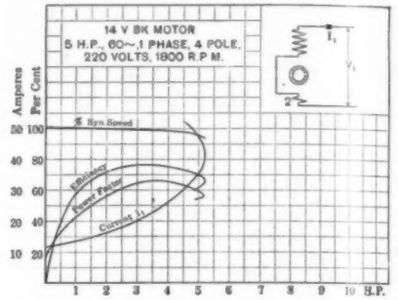


FIG. 5.—MOTOR RUNNING CURVES WITH BRUSHES REMOVED.

the usual Arnold form of single-phase motor are indicated in Fig. 6, and show that, while the Arnold motor yields an excess of starting torque, yet its torque falls rapidly with increasing speed. The new motor yields a starting torque of sufficient magnitude for all ordinary purposes, and goes on increasing this torque with increasing speed, thus insuring rapid acceleration. The motor

The Nicholson Arcing Ring.

The Nicholson arcing ring which is manufactured by the Locke Insulator Manufacturing Company, Victor, N. Y., is said to be a near approach to the solution of much of the lightning trouble upon power transmission lines. Ordinarily, after a lightning storm, a lineman finds the insulator entirely destroyed and it is usually construed as a punctured insulator. The fact probably is that due to an indirect stroke of lightning, that is to say, within a matter of a quarter of a mile or less of the line, surges have been induced upon the line causing the insulator to flashover. The power arc which follows, being naturally concentrated under the shells of the insulator in grounding to the pin, mechanically

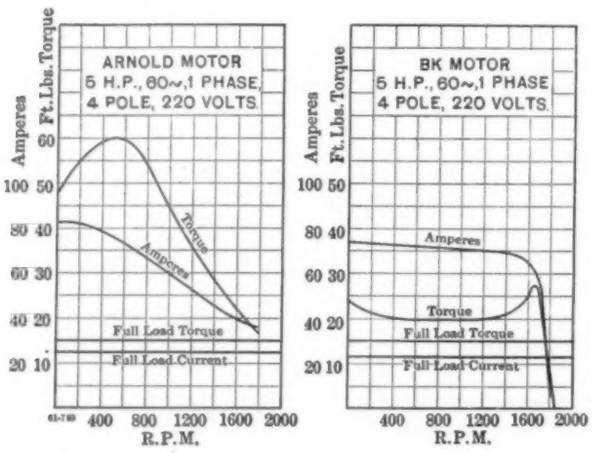


FIG. 6.—CURVES OF TORQUE CHARACTERISTICS.

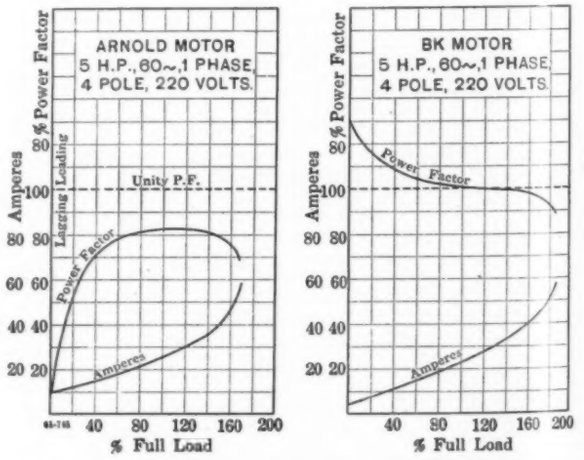


FIG. 7.—CURVES OF POWER-FACTOR CHARACTERISTICS.

short-circuited brushes placed at an angle to the main stator winding.

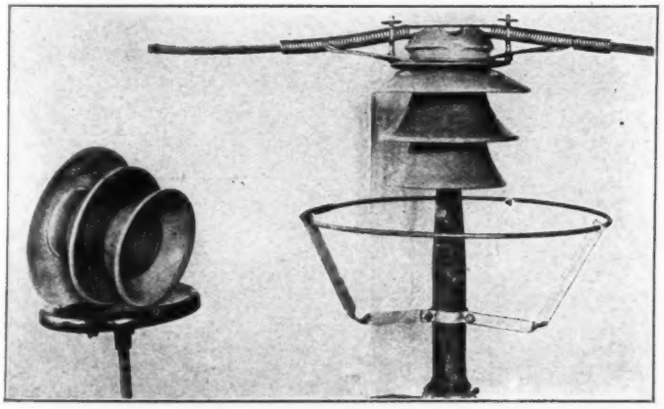
The squirrel cage absolutely prevents the B K motor from running away or "racing." This advantage over the single-phase commutator motor without the squirrel cage, claimed by the Wagner Company, is also very clearly set forth in Fig. 3.

The normal running performance will "pull through" any load it can start, whereas this is not always the case with the Arnold motor. The new motor can, when specially desired, be designed to give a starting torque from two to three times the normal running torque. A comparison of the Arnold and BK type power-factor and current curves is equally interesting and is shown in Fig. 7.

ruptures the insulator due to the concentrated heat of the arc and after the shells are thus cracked from this heat the current follows, creating the destructive effect noticed. Upon this analysis the arcing ring was based and its use up to the present time shows it to be correct. The device consists of two metal rings concentric with the insulator, a lower one which is situated

near the base being considerably larger in diameter than the insulator parts, and supported by grounded metal risers attached to the pin; and an upper one somewhat larger than the neck of the insulator, just opposite the tie-wire, suspended from the transmission cable, and electrically connected to it.

The installation of arcing rings allows flashover to take place between the upper ring, which is connected to the line cable, and the lower ring, which is grounded to the cross-arm or pin and the lower ring is so removed from the insulator as to avoid the heating above referred to. After the circuit-breakers have gone out it has been demonstrated that the line can be tied in again and the insulators are intact. This result is of course very gratifying as compared with the old condition of finding the line grounded through ruptured insulators, in which case it was necessary to send out linemen to make repairs before operation could be resumed. It will be immediately apparent that these appliances are specially valuable in the case of an important power load being carried on a single circuit where the load cannot be transferred to a duplicate line.



NICHOLSON ARCING RING.

The most conspicuous example of the use of these rings has been in the case of the Niagara, Lockport & Ontario Power Company.

Sofia Exhibition, 1912.

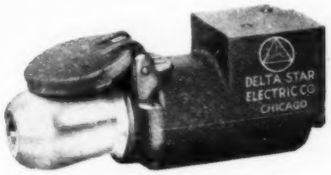
The international exhibition of Sofia will be opened in June and continue until September, 1912. The exhibition will embrace all products of industry, commerce, agriculture, arts, etc.

Full particulars may be had on application to the Organization Committee of the International Exhibition 5 Alexander Place, Sofia, Bulgaria.

A New Plug and Receptacle.

The increasing use of portable electric translating devices, such as small motors, lamps, batteries, etc., has developed a demand for a plug and receptacle which more nearly conforms to modern requirements than the older form of devices.

In general the considerations involved in the design of plugs and receptacles are first, to provide means for carrying the rated current of the device without excessive drop or heating; second, to carry such overloads as may be encountered in actual practice; and third, to insulate all live parts for maximum potential in a permanent manner both electrically and mechanically.



NEW PLUG AND RECEPTACLE.

The designers of the device shown herewith have given all these features most careful consideration with the result that a type has been developed in which many of the weaknesses of the older forms have been eliminated. The receptacle consists of an iron shell containing two flat contacts mounted in a fireproof insulating body impervious to moisture, acids or oils. This material has high insulation and mechanical strength, rendering impossible short-circuiting between the terminals. The receptacle can be mounted on a horizontal, vertical or angular position.

The plug consists of a metal shell containing two flat contacts imbedded in insulating material, and so designed that they lock into the receptacle contacts preventing accidental opening.

All parts are made with dies insuring interchangeability, a very essential feature in railroad service. This new device will be found of great value where a permanent highly durable construction is essential. The Delta-Star Electric Company is the manufacturer.

New Electric Sign Projector.

To utilize valuable advertising space, such as sidewalks, floors, ceilings, walls, etc., for electrical advertising, that was heretofore impossible to use, is the function of the electric sign projector, a device that has met with wide approval.

The accompanying illustration shows a new projector, the product of the Electric Ad-Lite Company, 32 Union Square, East, New York, N. Y., which has recently been placed on the market. This device is fifteen inches long and two and five-eighths inches in diameter, finished in gun metal. It weighs six pounds and may be used on either direct or alternating current. A permanent or intermittent flash, controlled by a platinum screw in the flasher box, may be obtained as desired. Used without the slide, a brilliant spot light is obtained which may be trained on any article desired.

NEW SIGN PROJECTOR.

Alabama Postoffice Has Electric Sign.

Probably the only postoffice in the United States to boast of an electric sign is the reinstated postoffice at New Decatur, Ala. Recently the postoffices in the two Decaturs were consolidated by order of the postoffice department. The people of New Decatur strenuously objected to this, with the result that the order from Washington was rescinded. In honor of the restoration the people of New Decatur installed an electric sign reading "New Decatur Postoffice, Alabama."

Individual Transformers for Lighting.

The demand for low-voltage transformers for use with tungsten lamps has been met by the Reduktor-Elektrizitäts-Gesellschaft of Frankfort on Main, Germany, by the design of transformers which can be mounted in the socket, the electrolier, ceiling pendant, and various forms of fittings. These transformers may be used upon circuits up to 250 volts, and give fourteen volts at the secondary terminals. The nipple and socket reductors are also supplied with bayonet fitting. One great advantage of this form of transformer is that it is only in circuit when the light is being used, and consequently the iron loss does not go on all the time. About 90,000 of these have already been put upon the market. A bell-ringing transformer with a no-load consumption of about one-half watt is manufactured by the same firm.

A New Electric Recording Instrument.

A new type of electric recording instrument particularly adaptable for use as a recording voltmeter or ammeter has been designed by the Brown Instrument Company and the Keystone Electrical Instrument Company of Philadelphia, Pa.

Recognizing the demand for a recording instrument which is both accurate in operation and simple in construction the Brown Instrument Company and the Keystone Electrical Instrument Company have spent much time in designing a recording instrument which can be mounted on the wall or switchboard and used by the most inexperienced workman.

In the common form of recording instruments no means are provided for shifting the recording-pen arm out of the way when the chart which received the record is changed, consequently there is serious danger of bending the pen in removing the chart. In this respect the new recording instrument is most novel in construction, in that the essential parts of the instrument are mounted on the door instead of in the case. The clock mechanism and chart alone remain in the case when the door is opened. Consequently there is no possibility of bending the pen because there is no occasion to handle it for any reason whatsoever. As soon as the door is thrown open the entire voltmeter system and the inking device is swung aside automatically, permitting the old chart to be easily removed and a new one substituted.

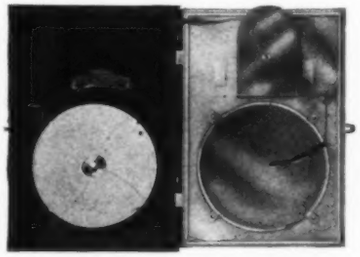
The accompanying illustrations show this recorder in operation with the door closed, and the instrument with the door thrown open ready to have a new record chart installed.

The millivoltmeter system which is used in this new recording instrument is a simplified form of the D'Arsonval

ELECTRIC RECORDING INSTRUMENT.

system used in electrical instruments of precision. Also the recording pen comes in contact with the paper momentarily only for the purpose of making a dot, thereby eliminating all friction between the pen and the chart.

An inking pad is placed immediately



INSTRUMENT WITH DOOR OPEN.

beside the pen, carrying sufficient ink for a week's supply, and this inking pad touches the pen point frequently, keeping it damp. When the door is closed the arm operated by the clock mechanism comes in contact automatically with the inking device, and every half minute or quarter minute, if preferred, it pushes the inking pad away from the pen, permitting it to swing freely.

Extension of Telephone Train Dispatching.

The Cincinnati, Hamilton & Dayton Railroad has recently placed an order with the Western Electric Company for seventy-nine of its telephone selectors and associated telephone apparatus to equip three new circuits. One circuit will extend from Indianapolis, Indiana, to Hamilton, Ohio, a distance of ninety-nine miles, and on it twenty-one selector-station equipments will be installed. The dispatcher will be located at Indianapolis.

The second circuit will extend from Dayton, Ohio, to Cincinnati, a distance of sixty miles, and will be equipped with twenty-four station outfits. The dispatcher will be located at Dayton.

A third circuit will extend from Dayton, Ohio, to Toledo, a distance of 140 miles, and thirty-four stations will be equipped. The dispatcher for this circuit will also be located at Dayton. No. 9 B. & S. copper will be used on all three circuits.

The Baltimore & Ohio Railroad is also extending its telephone train dispatching, having recently placed an order with the Western Electric Company for eighty-five selectors for use on five new circuits. Between Rockwood, Pa., and Johnstown, Pa., a distance of forty-five miles, there will be two circuits, each equipped with nine stations. One circuit will be used for train dispatching and the other for an intercalling message circuit.

Test of Atlas Engine.

In the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for September 30, there appeared a description of the Atlas crude-oil engine, with some data regarding a test of this engine showing the efficiency, amount of fuel per unit output, etc. On account of a number of typographical errors which occurred in the table giving the results of the test the table is correctly reproduced herewith.

TEST OF ATLAS CRUDE-OIL ENGINE.

Duration of test in hours	1.	1.5	3.	2.	2.5	4.	1.
Load in kilowatt-hours	67.	83.3	132.	173.5	200.4	205.75	249.
Kilowatts to compressor	24.75	22.66	23.6	25.5	29.6	29.25	31.
Transmission losses to compressor, 23.6 per cent	5.84	5.34	5.5	6.	6.98	6.91	7.31
Net kilowatts used by compressor	18.91	17.32	18.1	19.5	22.62	22.35	23.69
Net kilowatts delivered to line	48.09	65.98	113.9	154.	177.78	183.4	225.31
Same in horsepower	64.44	88.41	152.62	206.36	238.22	245.75	301.91
Generator efficiency per cent	87.	88.	89.	90.	91.	91.3	91.
Net horsepower of engine	74.	100.4	171.4	229.2	261.7	269.4	331.7
Revolutions per minute	174.7	174.1	173.13	173.1	172.9	171.9	171.
Fuel oil used, pounds per hour	50.	61.3	81.	108.	120.4	128.	167.
Pounds oil per kilowatt-hour	1.04	.93	.71	.7	.68	.7	.74
Gallons oil per 100 kilowatt-hours	14.22	12.73	9.73	9.6	9.27	9.55	10.15
Pounds of oil per horsepower-hour	.67	.61	.472	.47	.46	.476	.503
B.t.u. per horsepower-hour	12829.	11680.	9038.	9000.	8808.	9115.	9632.
Thermal efficiency of engine	19.8	21.7	28.1	28.3	28.9	28.	26.4
Fuel cost of kilowatt-hours in cents (oil at two cents per gallon)	0.284	0.255	0.195	0.192	0.185	0.191	0.203

Current Electrical News

COMMISSION NEWS FROM NEW YORK.

(Special Correspondence.)

The Public Service Commission for the Second District has authorized the Fort Plain Gas & Electric Light, Heat & Power Company to lease to the Mohawk Hydro Electric Company its plant in the village of Nelliston until the first day of May, 1921, with the option of renewal for a period of ten years thereafter. The Mohawk Hydro Electric Company is authorized to exercise a franchise granted by the village of Nelliston on December 20, 1910, to furnish electricity for light, heat and power in that village. The company is also authorized to exercise franchises granted by the town boards of Ephratah and Palatine to build electric transmission lines in these towns. An issue will be made of first-mortgage thirty-year six-per-cent bonds to the amount par value of $56,000 to provide funds for the building of the transmission line and the equipment necessary to operate under the franchises mentioned.

The granting of the application was opposed by the East Creek Electric Light & Power Company which now furnishes the Fort Plain company with power under a contract expiring July 1, 1914. The Commission finds that the East Creek Electric Light & Power Company holds no valid franchise in the village of Nelliston and its opposition is not that of an existing company operating in Nelliston; that the rights of the East Creek Electric Light & Power Company to market electric power in Nelliston are entirely incidental to its contract with the Fort Plain Gas & Electric Light, Heat & Power Company and expire with the contract in 1914; that the lease by the Fort Plain Gas & Electric Light, Heat & Power Company to the Mohawk Hydro Electric Company of its distribution system in Nelliston recognizes the rights of the East Creek Company and threatens no violation of these rights; that the Commission's disapproval of such a lease would be an abridgment of the right of the Fort Plain company to purchase elsewhere power not covered by the contract, and that such disapproval is without good and sufficient reasons; and that the terms of the lease between the Fort Plain Gas & Electric Light, Heat & Power Company and the Mohawk Hydro Electric Company are fair to both parties and are advantageous to the public, and that they insure an adequate supply of power.

As the result of a hearing held by the Public Service Commission, Second District, on the application of the Edison Electric Light & Power Company for authority to exercise franchises for the construction of poles, etc., and distribution of electricity for light and power in the village of Akin and the towns of Amsterdam, Mohawk and Florida, Montgomery County, Commissioner Sague, who conducted the hearing, announced that he would recommend that the requested permission be granted to the company. No company is at present supplying electricity to the localities in question.

On Monday a further hearing was given on the complaint of the Mayor of Schenectady against the Schenectady Railway Company, in which the Commission is asked to make an order requiring the sale of six tickets for twenty-five cents within the city limits.

On Wednesday at Albany a hearing was given to telephone corporations under the jurisdiction of the Commission on a proposed uniform system of accounts which the Commission has prepared for the use of these corporations. The Westchester Lighting Company was also asked to explain before the Commission why it has not complied with an order of the Commission prescribing uniform system of accounts for lighting companies.

Form of contract for the construction of Section 15 of Route 5 of the new subway system was approved by the Public Service Commission, First District. The contract, awarded to the Haggerty-Drummond Company, of Philadelphia, amounts to $3,820,129.

IMPORTANT DEVELOPMENT

(Special Correspondence.)

HIGHEST SPILLWAY DAM.—Construction work will soon begin on what is declared to be the highest spillway dam in the world at Long Lake, thirty miles north of Spokane, Wash., where the Washington Water Power Company will develop 90,000 electrical horsepower with four turbines, each 22,500 horsepower. The dam will be 320 feet in length, 190 feet at the highest point and 145 feet in width at the base, built of Cyclopean masonry. The spillway is to be surmounted with three roller dams, each nineteen feet in diameter and sixty-five feet in length. The tunnel, through which the flow of the Spokane River will be diverted, is 225 feet in length and opens into a cut of 250 feet. It is thirty feet in width and twenty feet in height, and carries 8,000 cubic-second-feet of water. The entrance of the tunnel is of concrete and steel girders. It is expected to complete the plans in 1912. The total cost of work and equipment is placed at $4,000,000.

LIGHTING AND POWER.

(Special Correspondence.)

CHAPMAN, KAN.—This city has voted $25,000 in bonds for an electric light plant.

MINERAL POINT, WIS.—The Commercial Club will install ornamental street lights. C.

MULDROW, OKLA.—This city is having plans prepared for an electric light plant.

PRAIRIE CITY, IOWA.—It is proposed to secure electric light for the town from Colfax, Iowa. C.

FLANDREAU, S. D.—Foster Phillips is considering the installation of an electric light plant. C.

CURTIS, NEB.—This city proposes to construct an electric light plant at a cost of about $7,500.

ELLIOT, IOWA.—Subscriptions of $4,000 have been secured for the installation of electric lights. C.

BOONE, IOWA.—The Boone Electric Company let the contract in Chicago for a 250-horsepower generator. C.

ALLIANCE, NEB.—S. C. Reck has commenced the erection of a building for the city electric light plant. C.

ABERDEEN, WASH.—The City Council contemplates the erection of a municipal electric lighting plant. A.

COLFAX, IOWA.—The Colfax Electric Light Company has been incorporated with a capital stock of $33,000.

MONTEZUMA, IND.—At an election held a short time ago it was voted to build a municipal electric plant.

NASHUA, IOWA.—The Nashua Power Company has been incorporated here with a capital stock of $21,000.

DEVILS LAKE, N. D.—This city will vote November 6 on issuing $33,000 in bonds for an electric light plant.

NORTH BRANCH, MINN.—The Eastern Minnesota Electric Company is to put in an electric light plant here.

YOAKUM, TEX.—The Creamery-Dairy Company will install a twelve-ton ice plant and an electric light plant here. D.

GROVE, OKLA.—An electric light and waterworks plant is soon to be established here. Bonds are already voted.

JOURDANTON, TEX.—The Atascosa Ice, Water & Light Company has been incorporated by T. P. Zanderson and others.

ELLSWORTH, WIS.—The plant of the Prescott Electric Company was damaged to the extent of several thousand dollars by the recent high water. C.

BEND, ORE.—The Bend Water, Light & Power Company has been granted franchises to operate in the new additions to the city. A.

GRIDLEY, CAL.—The Gridley Produce & Canning Company is making plans for the installation of a private power and lighting plant.

DUNLAP, IOWA.—A vote will be taken October 21 on granting a franchise to L. R. Beck of Council Bluffs, to install an electric light plant. C.

CEDARVILLE, CAL.—The Modoc County Irrigation Company will build a large hydroelectric power plant near Cowhead Lake, for lighting and power. A.

CLOVERDALE, B. C.—The British Columbia Electric Company will soon commence the construction of a power line from this place to Blaine, Wash. A.

IOWA FALLS, IOWA.—As a result of a special election O. F. Peterson has been granted a twenty-five-year franchise for an electric light and heating plant.

MILLVILLE, N. J.—The question of issuing bonds for the construction of a municipal light and heating plant will be taken up at the November election.

KEOKUK, IOWA.—The Stone & Webster Corporation is planning the expenditure of $325,000 on the reconstruction and improvement of the public utilities. C.

RED LAKE FALLS, MINN.—Joseph Perrault, city clerk, will receive proposals up to 8:30 p. m. October 26, for granting of an electric light and power franchise. C.

SEDRO-WOOLLEY, WASH.—The State Board of Control, Olympia, is asking bids for the erection of a power plant at the new Northern Hospital, Sedro-Wooley. A.

WHITE SALMON, WASH.—Preliminary work has been started on the power dam which is to be built at the Narrows near here by the Northwestern Electric Company.

TACOMA, WASH.—The Griffen Wheel Company has awarded a contract to the Evans-Dickson Company for the installation of a complete lighting system at its plant. A.

HUNTER, N. D.—The Hunter Light & Power Company has been incorporated by I. Moen; H. M. Weiser; Z. F. Hamilton and others to install an electric light plant. C.

FERGUS FALLS, MINN.—The Otter Tail Power Company will commence the immediate construction of a dam four miles below the city, to develop 2,000-horsepower. C.

WARBA, MINN.—This village will soon be lighted by electricity, generated at the plant of the Warba Hardwood Manufacturing Company. Many buildings have been wired.

VANCOUVER, WASH.—Two independent cables are to be laid under the Columbia River by the Portland Railway, Light & Power Company to furnish electric light for this city.

ROCHESTER, MINN.—The contract for the installation of an ornamental lighting system on Zumbro Street, between Main Street and Oak Street, was let to N. O. Hartig at $1,788. C.

DEADWOOD, S. D.—The Consolidated Power & Light Company is trying to secure the assistance of business men for the installation of forty ornamental electric light posts.

RED WING, MINN.—The power plant of the Clifton Light & Power Company was very badly damaged by recent floods. The dam in Kinnikinnick Creek was almost totally destroyed.

LEXINGTON, TENN.—Plans are being made to install an electric light plant in the near future. Estimates in regard to the cost of the plant are being considered by the city officials.

SEDRO-WOOLEY, WASH.—The Bellingham & Skagit County Interurban Railway Company has made application for a franchise to operate an electric lighting and power system in this city.

OCHELATA, OKLA.—The Ochelata Light & Water Company recently incorporated with a capital stock of $6,000, by J. F. Hughes, Arthur Davidson and J. Olsen, all of Oklahoma City.

READING, PA.—An ordinance has passed here compelling the Metropolitan Electric Company to put its wires underground. Work must be started within six months and finished within a year.

LIVERMORE FALLS, ME.—The Livermore Falls Light & Power Company is planning to effect marked improvements in its lighting system in the near future. Tungsten lamps are to be used.

MONTEZUMA, IND.—By a majority vote of the citizens of Montezuma it was decided to construct and equip an entirely new electric light and power plant. The old plant will be dismantled in a short time. S.

HAZELTON, B. C.—The Rocher de Boule mine plans for the erection of a hydroelectric power plant for mine operation. John F. Cowan, Salt Lake City, Utah, is interested in the development of this property. A.

ATLANTIC, IOWA.—The contractor for the electric light and water plant has thrown up his contract and the balance of the work, approximating $22,000, will be completed by his bondsmen.

ORANGE, N. J.—The Orange Common Council has taken over the lighting system, which was recently completed at a cost of $90,000. The plant was installed by Storms & Company of New Jersey.

OAKLAND, CAL.—The Pacific Gas & Electric Company has awarded a contract for an addition to its electric generating station on First Street, to the Bay City Iron Works, at a cost of $5,483. A.

SAN SIMON, ARIZ.—The Virtue Mining Company plans for the erection of an electric power plant in Cave Creek Canyon, with a distributing system to serve the many pumping plans in this district. A.

DUBUQUE, IOWA.—There is an agitation for boulevard lights. The Traveling Men's Greater Dubuque Club appointed W. J. Zollicoffer, Al Flick and others a committee to take charge of the matter. C.

JOLIET, ILL.—Work on the installation of a new lighting system is under way, and the officials of the Economy Light & Power Company state that the lamps will be installed and in operation by November 1.

MEDFORD, ORE.—The Southern Oregon Electric Company has been awarded a contract by the city for the installation of a cluster street-lighting system at a cost of $37 per post, plus extra cost for wiring. A.

BOISE, IDA.—The Great Shoshone & Twin Falls Water Power Company has been granted a franchise for a lighting and power system in South Boise. The grant provides for the installation within one year. A.

GOLDENDALE, WASH.—The Pacific Power & Light Company has been granted a franchise for a transmission line from Goldendale to Centerville, a distance of about seven miles. The estimated cost is $7,000. A.

MT. VERNON, IND.—A strong agitation is being made for the installation of street lights on the Martinsburg, Newark and Granville roads. The local power concern is the Mt. Vernon Railway & Light Company.

SAN ANGELO, TEX.—All of the wires of the San Angelo Telephone Company in the business district are being placed underground. The company is also making other important improvements to its system here. D.

WINNEMUCCA, NEV.—Work has been started on the foundation of the power plant being constructed by the Winnemucca Water & Light Company. When completed the plant will be one of the best equipped in the state.

MORRIS, MINN.—Fairbanks, Morse & Company have prepared plans for the installation of a light plant estimated to cost $15,000. J. H. McGuire and other business men have appointed a committee to consider the proposition.

BRYAN, TEX.—The City Council has made arrangements for issuing $8,000 of waterworks bonds, $7,000 of electric light bonds and $5,000 sewer bonds, proceeds of which will be spent in improving these public utility plants. D.

PLAINVILLE, MASS.—At a recent town meeting it was decided to contract with the Foxboro Electric Light Company for electric light for a period of three years. The lights are to be put in operation about the middle of November.

GREENFIELD, IND.—The merchants and county officials have contributed nearly $4,000 for the installation of an ornamental street-lighting system on the principal streets of the city. The city will supply current from the municipal plant. S.

MARYSVILLE, CAL.—Subscriptions to the extent of $5,000 have been received by the Chamber of Commerce for the erection of an electric light arch at Third and D Streets. Similar features are planned at Third and C, and Third and E Streets. A.

FLORENCE, ORE.—Applications for franchises have been made by the Florence Electric Company, for light and power, and by the Florence-Mapleton Independent Telephone Company, for a telephone system. An election was held October 16 for voting these ordinances. A.

SHERIDAN, IND.—The Town Board, after twenty years of municipal ownership and operation, has sold its lighting plant to a private company headed by J. L. Vickery, who has taken charge. Mr. Vickery states that the plant will be improved and some new machinery installed. S.

NORTHAMPTON, MASS.—A number of steam driver plants have recently installed motor drive, taking out the old machinery. The use of electrical power in local industries is increasing to a considerable degree. Power is supplied by the Northampton Electric Light Company.

BANGOR, ME.—President John R. Graham of the Bangor Railway & Electric Company announces that early next spring that corporation will replace the wooden dam at Veazie, four miles above Bangor, with a structure of re-enforced concrete and stone. Much power is at present being lost.

KENTLAND, IND.—A franchise has been granted to R. W. Howard and others for the construction, equipment and operation of electric light and power plants in this city, as well as in Goodland, Brook and Sheldon. Franchises have also been given for the construction of transmission lines. S.

KLAMATH FALLS, ORE.—It is the intention of the Siskiyou Light & Power Company, whose head office is at Yreka, Cal., to have all of its subsidiary plants connected by power lines with the main plant at Fall Creek, which is on the Klamath River below Keno, about forty miles from this city.

EDWARDSVILLE, IND.—The Edwardsville Gas & Electric Company has been incorporated under the Indiana statute to build, equip and operate a plant to supply the people of Edwardsville and vicinity with heat, light and power. Paul J. Schiller, Henry Dannettele and H. J. Peckinpaugh are directors. S.

CAMERON, TEX.—The Cameron Water, Power & Light Company which recently entered into a twenty-year contract to supply the city with lights and water will install about $18,000 of improvements. The plans and estimates for the proposed improvements have been made by N. Warrenfield of Dallas. D.

VANCOUVER, B. C.—The Western Canada Power Company has been granted permission by the Inland Revenue Department to deliver 5,000 kilowatt-hours per annum of electric energy to the Whatsom County Railway & Light Company, at Sumas, Wash. The latter company will distribute to Bellingham and vicinity. A.

GLENDIVE, MONT.—Articles of incorporation have been filed by the Glendive Heat, Light & Power Company. The company is capitalized at $100,000, much of which has already been subscribed The incorporators are George H. Hollecker, Nick Buttleman, R. H. Watson, H. A. Sample and Frank C. Hughes, all of Glendive.

WASHINGTON, D. C.—Work on the installation of 750 incandescent lamps, in the northwestern section of the city, is being rushed, and the whole system will probably be in operation by November 1. The work is being done under the supervision of Mr. Allen, of the electrical department of the District of Washington.

GRIMES, CAL.—Arrangements have been made by District 108 for the Pacific Gas & Electric Company to run a line from Knights Landing to Howell Point, to furnish power for a big reclamation pump. Statement is also made that the Northern California Power Company will soon begin building a line to Arbuckle and also one to Grimes.

HANFORD, WASH.—The American Power & Light Company has acquired the Hanford Irrigation & Power Company, and will operate in connection with its other properties. The local plant on Priest Rapids will be enlarged and the capacity increased. G. W. Talbot is president, and A. S. Grenier vice-president of this company. A.

CHARLESTON, S. C.—The Charleston Mining & Manufacturing Company recently placed an order with the General Electric Company for its Fort Meade, Florida, plant for a 1,250 kilovolt-ampere 2,300-volt, three-phase, horizontal turbine. This company has a 500-kilowatt General Electric steam turbine which has been in operation for nearly six years.

ROSWELL, N. M.—The Roswell Light & Gas Company has completed an addition to its electric light and power plant. The company has entered into contract with the Berrendo Land Company for furnishing electric power for irrigating work, on the Milne-Busch property, at $1.25 per acre foot, with proportional decrease according to consumption. A.

GREENVILLE, CAL.—The Indian Valley Electric Light & Power Company has acquired a power site on the north fork of the Feather River, and plans for the erection of a hydroelectric power plant, with a transmission line to Indian Valley. The company will soon commence the construction of a power line from Greenville to Taylorville and Crescent Mills. A.

TRENTON, N. J.—Arrangements are being made by the Public Service Corporation to furnish electricity for Princeton, Monmouth Junction, Cranbury, Skillman, Hopewell and other nearby places from the local plant on Chancery Street. When necessary changes are made at the local plant the power house at Rocky Hill will be abandoned. Machinery to provide 2,000 additional horsepower will be installed at the local plant.

DENTON, TEX.—The Waterworks Committee of the City Council will greatly improve the city electric light and power plant, and has contracted for about $10,000 worth of new machinery. A new generator, practically double the size of the present one, will be installed and a 300-horsepower engine has been purchased. The work of installing the new machinery and improving the plant otherwise will be begun in a short time.

INDIANAPOLIS, IND.—The Indiana Service Company, which proposes to supply electric light and power to Batesville, Shelbyville, Greensburg, Connersville, Rushville, Greenfield, Newcastle, Anderson, Ellwood, Tipton an Noblesville, with headquarters at Anderson, has filed articles of incorporation. The concern is capitalized at $10,000. The directors are Clement W. Hooven, Howard L. Otis, John T. Bacon, Charles A. Wilson and Henry D. Hughes.

INDIANAPOLIS, IND.—A petition has been filed with the Board of Public Works asking that no more payments be made from the public funds to the Indianapolis Light & Heat Company for electric current, until the company files a schedule of rates charged to private consumers. The petition alleges that a higher rate is charged consumers where there is competition and that many have refused for the past eight months to pay the discriminating rates and still the company has failed either to bring suit to collect the amounts due, or shut off the current. The company's franchise provides that the rates shall be the same to all consumers of a similar class. S.

ST. MARY'S, O.—The work in the vicinity of St. Mary's involving the construction of dams strengthening of reservoir banks and dredging the Miami & Erie Canal for the impounding of floodwater and delivery of same to the electrical power plant now under construction near Defiance, O., will cost more than $75,000 according to the estimates furnished. A contract with the state permits the company to utilize surplus water to operate their water wheels. The company bears the expense of the conservation program, the outlay being regarded as a portion of the rental for the privileges thus obtained. The contract has been awarded to Edward Bodette, of Toledo, for the dredging of the Miami & Erie Canal to Spencerville. It is also proposed to construct a dam across the St. Mary's river, raising the water level about six feet and deflecting the surplus water into the canal to be used in the power plant near Defiance. H.

HARRISBURG, PA.—Two mergers of lighting companies were recently approved by Governor Tener. The first, the Edison Electric Company, of Lancaster, with a capital of $1,500,000, is formed from the following companies: Edison Electric Illuminating Company, of Lancaster; Columbia Light Heat & Power Company, Lititz Electric Light, Heat & Power Company, Mountvile, Penn township, Rampho township, Mt. Joy township, East and West Donegal Townships Electric Light Companies, East and West Lampeter Township, East and West Hempfield Township, Manor Township, Manheim Township, Warwick Township and Lancaster Township Electric Companies and Manheim Suburban Electric Company. The officers are: W. W. Griest, Lancaster, president; George Bullock, New York, vice-president, and J. S. Graybill, Jr., secretary and treasurer. The Edison Electric Illuminating Company, of Sunbury, was formed, with $250.000 capital, by the merger of the Sunbury Gas, Edison Electric Illuminating, Sunbury Electric Light & Power companies. The officers are: George Scott Stewart, Philadelphia, president; W. W. Hepburn, Philadelphia, vice-president, and E. R. Tatnall, Haverford, secretary and treasurer.

ELECTRIC RAILWAYS.

(Special Correspondence.)

WATERLOO, IOWA.—The Waterloo, Cedar Falls & Northern Railway will build an extension or interurban to La Porte City. C.

SHAWANO, WIS.—The Wisconsin & Northern Railroad has been granted a certificate to construct a line from Kaukauna and Appleton to Neenah. C.

CONNERSVILLE, IND.—The Commercial Club is aiding in the organization of a company to build and operate an electric railway to Rosedale and other suburban territory.

INDIANAPOLIS, IND.—The Indianapolis & Delphi Traction Company has entered into a tentative contract with the Mansfield Construction Company to build an interurban road from Indianapolis to Sheridan. S.

NATIONAL CITY, CAL.—The work of relaying the track of the electric division of the San Diego Southern Railway, between National City and San Diego, will start at once. New ties and heavier rails will be put in.

SAN DIEGO, CAL.—The San Diego Electric Railways will soon be in the market for twenty-five street cars, of type to be decided upon. The company plans to double-track its Old Town line, and several other lines in the city. A.

FT. WAYNE, IND.—The Ft. Wayne & Northern Indiana Traction Company has ordered twelve pay-as-you-enter cars for use on the city systems in Logansport and Lafayette. The new cars will be put in service late in December.

ALLENTOWN, PA.—The line of the Montgomery Traction Company between Norristown and Iansdale has been purchased by the Lehigh Valley Transit Company. The system bought has fourteen lines of track, and is capitalized at $250,000.

MT. AYR, IND.—Eugene Burtelle, who is constructing an interurban road from Lafayette to Hammond, reports that eighteen miles of the grade between Mt. Ayr and the Kankakee River in Newton County has been completed ready for the rails. S.

CRESTON, IOWA.—The Creston, Winterset & Des Moines Railroad Company has been incorporated here to build a line from Creston to Des Moines, about seventy-five miles. The incorporators are wealthy farmers living along the right-of-way.

VINCENNES, IND.—The commissioners of Knox County have ordered a subsidy election in Harrison township to be held November 21 to vote on a proposition to aid by taxation the construction of the Vincennes Southeastern Traction Company's line. S.

MARTINEZ, CAL.—The Oakland & Antioch Electric Railway Company contemplates the construction of an electric railway from Walnut Creek to Martinez, through the Alhambra Valley. The road will be known as the Oakland-Alhambra Railway & Ferry Company.

GARY, IND.—The Indianapolis, Chicago & Meridian Traction Company has been granted a franchise to enter the city. This company proposes to build a road to connect Indianapolis, Sheridan, Flora, Binghurst, Monticello, Hammond, Gary and Chicago. M. J. Mooreland, Indianapolis, is secretary.

SAN FRANCISCO, CAL.—The United Properties Company has given out a contract for $2,000,000 worth of electrical equipment. It is believed that this is the first move toward important extensions of the Key Route system. According to President E. A. Herron work on the system north of Richmond and south of San Jose will be rushed during the next few months.

PORTLAND, ME.—The Portland & Brunswick Street Railway property has been sold at auction to Harry B. Ivers, of Lewiston, the only bidder, for $225,000. The sale was due to a suit brought by the Augusta Trust Company, holders of bonds to the amount received. The system is operated between Brunswick and Yarmouth and will continue under the same officials now serving.

MARTINSVILLE, IND.—A movement is on foot in Morgan and Hendricks Counties to build a narrow-gage rural railroad to connect Clayton, Monrovia, Hall and Eminence. Paul H. White, a consulting engineer of Indianapolis, has evolved the plan and interested the citizens along the proposed line. Mr. White's plan calls for a thirty-inch-gauge road with light-weight cars, electric, steam or gasoline power. S.

VICTORIA, TEX.—The St. Louis, Brownsville & Mexico Railway Company has been granted a franchise by the City Council to construct and operate here a system of motor cars. This company is planning to extend its steam railway from Bloomington to Victoria, and the proposed motor car system in this city will be operated in connection with that line. The company was recently granted a similar franchise for the use of the streets of Brownsville. D.

TEMPLE, TEX.—A syndicate of Dayton, O., men, headed by Dr. S. F. George, has under consideration the proposition of constructing an interurban electric railway between Temple and Marlin, a distance of about thirty miles. The promoters of the project are asking a bonus of $75,000 from the people of the towns on the route in aid of the enterprise. Of this amount the people of Temple will be required to donate about $50.000. The matter of raising the required bonus is now receiving attention. D.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

SHELL LAKE, IOWA.—M. E. Albee has purchased the local telephone system and will make improvements.

DUPREE, S. D.—F. E. Sexton, of Timber Lake, has been granted a franchise to build a telephone line in this county.

GWINNER, N. D.—The Forman, Rutland & Havana Telephone Company has been incorporated with a capital stock of $10,000.

FORT STOCKTON, TEX.—The Pecos & Rio Grande Telephone Company has been incorporated with a capital stock of $120,000.

SUSANVILLE, CAL.—The Johnstonville Telephone Company has been granted a five-year franchise for a telephone system here.

LOS ANGELES, CAL.—The Pacific Telephone & Telegraph Company has taken over the system of the San Fernando Telephone Company.

COSMOPOLIS, WASH.—The Pacific Telephone & Telegraph Company has been granted a franchise for a telephone system in this town.

PETALUMA, CAL.—The Gugielmetti Telephone Company has awarded a contract for the construction of a line to Cotati, to W. D. Thomas. A.

GLENBURN, N. D.—The Lone Star Rural Telephone Company has increased its capital and will make considerable improvements and extensions.

FRESNO, CAL.—A complete telephone system is to be established along the route of the Guarantey Pipe Line Company from the Midway oil field to Ventura.

LAKEVIEW, ORE.—The Nevada, California & Oregon Telephone & Telegraph Company has awarded a contract to C. H. Lee for the construction of its lines to this city. A.

MARLIN, TEX.—The City Council has granted a franchise to J. B. Earle of Waco and associates for installing an independent telephone exchange. The work of installation will soon be started.

ORLAND, CAL.—The Glenn County Telephone Company has acquired the private Hackheimer telephone line between Orland and Willows. This gives the company two lines between these places. A.

VICTORIA, TEX.—The Southwestern Telephone & Telegraph company has just completed another rural telephone line in this county. This makes three complete belt lines now in operation in the county.

GUAYMAS, MEX.—The Sonora Telephone Company is asking bids for the construction of a line from Guaymas to Hermosillo. The work is estimated to cost about $75,000. C. W. Forbes is general manager. A.

DE QUINCEY, LA.—The De Quincey Telephone Company has been incorporated with this city as headquarters. Officers are as follows: President, J. M. Newhouse; vice-president, J. H. Guidewell; secretary and treasurer, W. R. Watkins.

HEARNE, TEX.—The Southwestern Telephone & Telegraph Company has purchased the property of the Hearne Telephone Company which was controlled by T. O. McGuire, the consideration being $16,500. The purchaser will take control November 1. D.

AURORA, ORE.—The Home Telephone Company has acquired a controlling interest in the United Telephone Company, which operates in Aurora, Canby, Hubbard, Woodburn and other towns in this district. The new owners contemplate improvements in the system. A.

BENTLEY, ORE.—The Bentley Telephone Company has been incorporated by D. S. Bentley and William F. Schaad, with a capitalization of $10,000. The company plans for the construction of a system in Polk, Yamhill and Tillamook counties, with main station at Bentley. A.

NORTH FORK, CAL.—H. E. Bigelow has commenced the construction of a telephone system from this place to Clovis, via Bellview, O'Neals and Pollasky. Stations will be established at these points. Connection will be made with the lines of the Pacific Telephone & Telegraph Company at Clovis. A.

HEBER SPRINGS, ARK.—The owners of rural telephone lines over various parts of Cleburne County have organized a company and will put in a system of phone lines throughout the county with a central office at this place. This movement is the result of the raise in rates for physical connection at this place, recently made by the Southwestern Telephone & Telegraph Company.

NEVADA CITY, CAL.—The telephone line between North Bloomfield and Sierraville has been completed and is now in service. The work on the forty-five mile line in Placer County has also nearly been completed. A total of about 100 miles of telephone lines has been constructed this season in various parts of the forest, and next year a great deal more is contemplated.

WIOTA, IOWA.—A new telephone company has been incorporated for Wiota, which will take over the stock of the old company and conduct the telephone business for Wiota and vicinity. The officers of the new company are R. R. Bell, president; T. E. Ostrus, vice-president, and D. R. Love, secretary and treasurer. The board of directors is made up of the above-named officers and J. D. Clauson, A. J. Karetens.

ELECTRICAL SECURITIES.

DIVIDENDS.

American District Telegraph Company of New Jersey; regular quarterly dividend of one per cent, payable October 28.

Edison Electric Illuminating Company, of Brockton, Mass.; a semi-annual dividend of $4 a share, payable November 1.

Electric Bond & Share Company; regular quarterly dividend of two per cent on the common stock, payable October 14 to stock of rceord October 13, and regular quarterly dividend of one and one-quarter per cent on the preferred stock, payable November 1.

Guanajuato Power & Electric Company; quarterly preferred dividend of one and one-half per cent, payable November 1.

Havana Electric Railway Company; common dividend of one and one-half per cent, and preferred of one and one-half per cent, both payable November 11.

Michigan State Telephone Company; quarterly common dividend of one and three-quarters per cent, and preferred dividend of one and one-half per cent, both payable December 1.

Minneapolis General Electric Company; a dividend of $2.00 per share, payable November 1.

Montreal Street Railway Company; quarterly dividend of two and one-half per cent, payable October 25.

Railways Company General; regular quarterly dividend of one per cent, payable November 1, to stock of record October 21.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES IN THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK

NEW YORK.

	Oct. 16.	Oct. 9.
Allis-Chalmers common	3	1⅜
Allis-Chalmers preferred	11	11
Amalgamated Copper	52⅛	48⅝
American Tel. & Cable	74	*78¾
American Tel. & Tel	135¼	133⅝
Brooklyn Rapid Transit	75½	73⅜
General Electric	150½	148
Interborough-Metropolitan common	15⅛	14½
Interborough-Metropolitan preferred	45½	44½
Kings County Electric	129	129
Mackay Companies (Postal Telegraph & Cables) common	86	84¼
Mackay Companies (Postal Telegraph & Cables) preferred	72½	72⅜
Manhattan Elevated	134	132
New York & New Jersey Telephone	103	103
Pacific Tel. & Tel	44	42¾
U. S. Steel common	61⅛	58⅝
U. S. Steel preferred	109⅞	108½
Western Union	79¼	78⅝
Westinghouse common	63⅜	61
Westinghouse preferred	111	115

BOSTON.

	Oct. 16.	Oct. 9.
American Tel. & Tel	135½	133⅝
Edison Elec. Illuminating	286	283
General Electric	151	148
Massachusetts Electric common	20⅛	19
Massachusetts Electric preferred	94¼	90½
New England Telephone	145½	145
Western Tel. & Tel. common	19½	19
Western Tel. & Tel. preferred	95	95

PHILADELPHIA.

	Oct. 16.	Oct. 9.
American Railways	44	44
Electric Company of America	11⅞	11⅝
Electric Storage Battery common	52¼	50⅜
Electric Storage Battery preferred	52¼	50⅜
Philadelphia Electric	16⅜	17
Philadelphia Rapid Transit	22¾	21½
Philadelphia Traction	82¼	83
Union Traction	50¾	49⅝

CHICAGO.

	Oct. 16.	Oct. 9.
Chicago Elevated common	25	23
Chicago Elevated preferred	90	93
Chicago Railways, Series 1	92	87
Chicago Railways, Series 2	28	27
Chicago Subway	8	1⅝
Chicago Telephone	119	119½
Commonwealth Edison	127⅛	134½
National Carbon common	100	100
National Carbon preferred	117	117

PROPOSALS.

NAVAL SUPPLIES.—The Bureau of Supplies and Accounts, Navy Department, is calling for proposals until October 31, for the following:

One rapid-action punch and riveter, to be driven by an alternating current, 220-volt, three-phase, sixty-cycle motor, Norfolk Navy Yard.

One power press or brake, to be driven by a 220-volt, three-phase, sixty-cycle motor, Norfolk Navy Yard.

Until November 14, for the Mare Island Yard:

Engine lathe, driven by alternating-current motor.

Until October 31, for the Philadelphia Yard:

Two electric hoists, two-ton, two-rope drive by 220-volt variable-speed motor, of not less than six horsepower, controller to be of standard cylinder type.

One hand, self-feeding ripping and resawing machine, equipped with one direct-connected, direct-current, 220-volt constant-speed, inclosed and dust-proof motor. Type C, class 2. Automatic starter to be wholly electrical in operation.

One double-cylinder, four-roll surfacer, motor driven, belt connected, to be equipped with one direct-current, enclosed, dust-proof, 220-volt motor. Type C, class 1, automatic starter to be wholly electrical in operation.

Until October 24, for the Brooklyn Navy Yard:

Five exhausters, three with enclosed and two with open motors.

Seventeen blowers, with enclosed motors.

Twenty-two blowers, with open motors.

PERSONAL MENTION.

ANGUS S. HIBBARD was a guest of the Chicago Association of Commerce at its weekly luncheon, October 11.

W. H. TREVIS, general superintendent of the Colusa County Telephone Company, Colusa, Cal., has resigned.

L. J. CORBETT, of Spokane, Wash., has been appointed associate professor of electrical engineering at the University of Idaho, at Moscow.

HARRIS J. RYAN, professor of electrical engineering in Leland Stanford University, is on leave of absence this year. His address is La Jolla, California.

L. R. GEISSLER, of Cornell University, has been appointed associate psychologist in the physical laboratory of the National Electric Lamp Association, Cleveland, O.

R. C. LANPHIER, manager of the Sangamo Electric Company, delivered an address on October 18 before the Car Lighting Club, at Chicago, Ill., on "Ampere-Hour Meters."

G. C. NOBLE, consulting engineer and assistant professor of electrical engineering at the University of California, Berkeley, has resigned to become associated with the Pacific Gas & Electric Company, San Francisco.

W. H. PAPE, who has for the past five years been general manager of the Pittsburg & Butler Street Railway Company, has resigned to enter the manufacturing field. Mr. Pape was succeeded by E. C. Carpenter of Anderson, Ind.

J. J. WOOD, factory manager of the Ft. Wayne Electric Works of General Electric Company, has returned from an extended tour of the European countries, where he observed the work and electrical development in the old world.

R. HANSCHKE, JR., graduate of the Agricultural and Mechanical College of Texas and Technical School of Hanover, Germany, has recently accepted the position of eastern representative of the Charles L. Kiewert Company. His office address is 165 Greenwich Street, New York City.

CARYL D. HASKINS, manager of the lighting department of the General Electric Company, personally supervised the installation of electrical apparatus at the town of Austin, Pa., following the flood which recently destroyed that place. A temporary plant was put in so that light might be furnished to flood sufferers and relief parties.

GANO DUNN has just returned from abroad, where, as a representative of the United States Government and as president of the American Institute of Electrical Engineers, he has been attending the International Electrical Congress at Turin and the meeting of the International Electrotechnical Commission. Mr. Dunn, who for many years was first vice-president and chief engineer of the Crocker-Wheeler Company, and is a past president of the New York Electrical Society, has been elected a director and a vice-president of J. G. White & Company, Inc.

ADOLF FRANKE, director of the Siemens & Halske Aktiengesellschaft, who arrived here October 13 to pay a visit to this country, will represent the "Verband Deutscher Electrotechniker" at the Helmholtz celebration, which has been arranged by the American Institute of Electrical Engineers. Dr. Franke was accompanied by Dr. A. Ebeling, chief of the Pupin department of Siemens & Halske, and well known among the profession for his researches on, and designs of, Pupin lines and Pupin cables. These gentlemen accompanied by Karl Georg Frank will visit a number of the most important telephone and telegraph installations in this country, and wish to study especially the effect of high-tension transmission lines on telephone and telegraph lines and long-distance telephonic and telegraphic transmission in general.

OBITUARY.

HARRY A. FAIRCHILD, chairman of the Washington Public Service Commission, died of apoplexy October 8, at his home in Olympia, Wash. His wife and son survive him.

WILLIAM W. SWAN, who as a patent lawyer was actively identified with the telephone industry, died at his home in Brookline, Mass., October 6. Mr. Swan was a member of several clubs in Boston, where his business was located. He leaves a widow and one son.

NEW INCORPORATIONS.

NEW YORK, N. Y.—The Conlon Electric Manufacturing Company was recently incorporated with a capital of $25,000 by Sayers Brothers, George A. Reading, William H. La Farge and Mae E. Reading.

NEW YORK, N. Y.—The Electric Mail Carrier Company was incorporated by Alfred R. Bunnell, Charles E. Reid, William J. Griffiths and Charles G. Rice with a capital of $25,000.

WILMINGTON, DEL.—The Minnesota-Wisconsin Corporation of Winona, Minn., with a capital of $2,000,000 has been chartered at Dover, Del. The incorporators are W. B. Parsons, C. P. Crangle and James Ritchie, all of Winona. The corporation is empowered to construct and operate works for the manufacture and distribution of gas and for the generation and sale of electric current.

INDUSTRIAL ITEMS.

THE AMERICAN DISTRICT STEAM COMPANY announces the removal of its general offices from Lockport, N. Y., to its new works at North Tonawanda, N. Y.

THE GENERAL MOTORS TRUCK COMPANY, Detroit, Mich., is distributing booklets on General Motors Company electrics. Some of the special advantages of these electric trucks are given in a new form.

THE PACIFIC ELECTRIC HEATING COMPANY, Ontario, Cal., directs especial attention to its electrical radiators in the October issue of *Hot Points*. Some interesting information is also given regarding the El Boilo immersion heater.

THE SHELBY MANUFACTURING COMPANY, Shelby, O., has issued a catalog covering types, prices and discounts on Shelby incandescent lamps of all classes, in large, street-series and miniature styles.

W. N. MATTHEWS & BROTHER, St. Louis, Mo., advertises the Matthews O. K. sleet cutter on a recently mailed post card. These devices are inexpensive and are easily attached to the trolley harp.

MIX & GENEST, Berlin, Germany, is distributing a pamphlet describing its system of signaling by means of lights in place of the ordinary annunciator bells. These are intended for use in hotels, hospitals, private residences, etc.

THE WESCO SUPPLY COMPANY, St. Louis, Mo., has included an interesting article on the illumination of show windows, in the October issue of its publication, *The Red Shield*. A number of illustrations and descriptions of seasonable electrical articles add variety and interest to the publication.

THE DELTA-STAR ELECTRIC COMPANY, Chicago, Ill., has been awarded the contract for installing a new type of automatic oil circuit-breaker for controlling the arc circuits of the new Chicago street-lighting system. The new circuit-breakers have a rating of fifteen amperes at 12,000 volts. The contract was awarded by the Sanitary District of Chicago.

WOODMANSEE, DAVIDSON & SESSIONS, Chicago, Ill., consulting engineers and experts in lighting, heating, power and refrigerating projects, have established an office at 629-630 Wells Building, Milwaukee, Wis. This office will be under the personal supervision of Mr. Davidson, who will be assisted by a staff of specialists in each branch of engineering covered by the organization.

MACHINENFABRIK OERLIKON, Zurich, Switzerland ,has issued pamphlets describing motors for grinding coffee, single and polyphase asynchronous motors for large powers in both low and high speeds, high-voltage testing transformers, and electromagnets for the use of oculists. The latter can be used not only for operations on the eye, but also to remove particles of iron from other parts of the body.

THE GARWOOD ELECTRIC COMPANY, Garwood, N. J., for which Charles N. Fowler, Jr., of Elizabeth, N. J., has been appointed receiver in chancery, is not only completing its unfilled orders, but is also taking new business. The assets of the company are largely in excess of its liabilities. All of the branch offices of the company are soliciting business, as usual, and reorganization plans are now being considered.

H. G. McFADDIN & COMPANY, New York, N. Y., compares the tallow dips of Benjamin Franklin's time with the modern "desk-top daylight" of today as secured with the Emeralite, in a recent advertising post-card. The Emeralite shade is of glass, of an emerald-green color outside and opal inside. The construction of the lamp is simple. The post-card illustrates two types of the Emeralite lamp in color.

THE CUTTER COMPANY, Philadelphia, Pa., has prepared a "Handbook of the I-T-E Circuit-Breaker," which is a combined text book on the use of circuit-breakers, and a price list of the company's product. The work is indexed so that all information, drawings and prices of each type of breaker may be easily found. As the book is strongly bound in cloth it is suitable in appearance as well as in subject matter, for an addition to any electrical reference library.

THE TERRY STEAM TURBINE COMPANY has, through its testing department, been carrying on some interesting and extensive tests on turbines on order. Several government tests have been conducted, including those of the eighty-five-kilowatt lighting sets for the *U. S. S. Yosemite*, as well as several smaller turbo-generators. Several of the commercial tests were of such a nature as to attract special attention, notably one of high-pressure gas blowers, which has been published in several of the technical journals.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, Pittsburgh, Pa., has issued several publications describing its supplies, etc. Folder 4190, which is prepared in an original manner, is intended for distribution among tailors, and lists a complete line of Westinghouse electric tailor's irons. Folders 4210 and 4217 are devoted to watthour meters Type OA, and Type C. In folder 4215 is contained a description of Westinghouse alternating-current switchboard meters, and in 4216 direct-current switchboard meters are described.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., has recently distributed a number of bulletins describing its various

lines of machinery. Bulletin No. 1078 deals with large alternating-current generators, while Bulletin No. 1082 takes up the direct-current type. The remaining publications are as follows: Bulletin No. 1070 on barometric condensers, Type "B"; Bulletin No. 1519 on barometric condensers, Type "A N"; Bulletin No. 1074, on direct-current motors and generators, types "H" and "H T"; and Bulletin No. 1068 on direct-connected Corliss engines.

THE BOSTON INCANDESCENT LAMP COMPANY, manufacturers of refilled carbon incandescent lamps, reports that it has booked a larger volume of business during the month of September than during any previous month in its history. This company, which sells lamps at very minimum prices for standard types and voltages in the carbon-filament class, attributes its growing business to the fact that while there is a rapidly increasing demand for high-efficiency incandescents, there is, and perhaps always will be, a legitimate place for lamps of comparatively low efficiency at a very low price.

THE GREEN FUEL ECONOMIZER COMPANY, Matteawan, N. Y., has published a booklet entitled "Heating and Ventilating." The text takes up not only the usual details relating to the construction of fans, heaters and heating and ventilating systems, but also the calculation and designing of piping systems, giving for the latter two methods differing somewhat, viz.: that used in the office of the Supervising Architect at Washington and that proposed by Riltschel and covering the resistance of sheet-iron pipes and of angles, bends, branches, grills or registers, etc. The general illustrations of the book include not only views of buildings equipped with heating and ventilating apparatus built by the Green Fuel Economizer Company, but also detailed plans, elevations and "ghost" views showing the actual arrangement of the fans, heaters, piping, outlets, etc.

THE DE LAVAL STEAM TURBINE COMPANY, Trenton, N. J., presents an extended discussion of different types of steam turbines and their comparative merits in a recent bulletin entitled "A Steam Turbine for Driving Direct-Current Generators." The arrangement favored for large units is the combination of multi-staging with reduction gears, the use of the reduction gear permitting the driven machine to be operated at the speed desired, at the same time allowing the turbine to be designed for the speed most favorable to durable and reliable construction and to freedom from distortion and other troubles encountered with the long shafts required where a very large number of stages are used. The use of a number of stages instead of one stage, as in the DeLaval single-stage turbine, permits of turbines of moderate diameters being built for the largest capacities, since with the lower speed, longer vanes or buckets can be used in the low pressure stages. The booklet describes a line of machines in which this idea has been developed as applied to driving direct-current generators and to the direct driving of centrifugal pumps, blowers and air compressors and for rope or belt transmission.

DATES AHEAD.

American Mining Congress. Fourteenth annual meeting, Chicago, Ill., October 24-28.

Illinois State Electric Association. Annual convention. Rockford, Ill., October 24, 25 and 26.

Telephone Pioneers of America. Boston, Mass., November 2-4.

Association of Railway Electrical Engineers. Annual convention, Hotel La Salle, Chicago, November 7-10.

Alabama Light and Traction Association. Montgomery, Ala., November 14 and 15.

Ohio Society of Mechanical, Electrical and Steam Engineers, Canton, O., November 17 and 18.

Association of Railway Telegraph Superintendents. Joint meeting of eastern and western divisions, Chicago, Ill., November 23 and 24.

Los Angeles Electrical Exposition. Los Angeles, Cal., November 25-December 9.

American Institute of Chemical Engineers. Annual meeting, Washington, D. C., December 20-22.

National Electric Light Association. Next annual convention, Seattle, Wash., June 10-14, 1912.

National Electrical Contractors' Association. Annual meeting, Denver, Colo., July 17-20, 1912.

The 1912 Boston Electric Show. Mechanics Building, Boston, Mass., September 28-October 26, 1912.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) October 10, 1911.

1,005,121. CIRCUIT-INTERRUPTER. Christian Aalborg, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa. Filed Oct. 7, 1908. Combined with the stationary and movable contact members is an oil tank in which the members are disposed having an enlargement at the surface of the oil for increasing the cross-sectional area at this point.

1,005,129. ELECTRIC-LAMP AND SERIES-CIRCUIT CUT-OUT. Frederick W. Andrew, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Co. Filed Sept. 20, 1906. A reciprocating block carries movable terminals that connect a series lamp into the circuit in one position and short-circuit the lamp in the other position.

1,005,163. TRANSFORMER. Frank Conrad, Swissvale, Pa., assignor to Westinghouse Electric & Manufacturing Co. Filed January 10, 1908. A step-down transformer for lamp service has brackets mounted between the core and windings, insulating blocks secured to the brackets, a socket mounted on one block and an attachment plug on the other.

1,005,166. ELECTRICALLY-HEATED TRAY. Florence L. Crombie, Detroit, Mich. Filed May 8, 1911. Has heating units arranged in the bottom adjoining an asbestos plate.

1,005,179. GUARD FOR TELEPHONE AND TELEGRAPH WIRES. Charles John Elliott, Oxnard, Cal. Filed July 11, 1910. In combination with high-tension wires forming a metallic circuit for electrical transmission is a guard surrounding each wire and electrically connected with another of the wires of different potential from the one it surrounds.

1,005,192. BINDING POST. George Garretson, San Diego, Cal. Filed Jan. 17, 1911. Comprises a threaded bolt having a head provided with notches in each side adapted for electric wires and a nut adapted to screw on the bolt and against the wires.

1,005,194. TELEPHONE SYSTEM. Thomas W. Gleeson, Boston, and Willard H. Gilman, Medford, Mass., assignors to International Telemeter Co. Filed Aug. 5, 1907. Gives details of a selective party-line system.

1,005,199. BATTERY-CONNECTOR. Julius H. Gugler, Milwaukee, Wis. Filed Jan. 22, 1909. An electrode of porous material has a cavity therein, an electric connecting plug socketed in the cavity, and a bath of non-conducting liquid impervious to an electrolyte and permeating the pores of the electrode and surrounding the contact between electrode and the member.

1,005,221. MOTOR CONTROL. John D. Ihlder, New York, N. Y., assignor to Otis Elevator Co., Jersey City, N. J. Filed Oct. 11, 1905. A control for an alternating-current motor includes resistances inserted in the rotor circuit while starting and again inserted in a power-consuming rotor circuit while retarding.

1,005,222. ELECTRODYNAMIC BRAKE CONTROL. John D. Ihlder, New York, N. Y., assignor to Otis Elevator Co. Filed March 13, 1908. Combined with a motor is an electromagnetic brake, an electrodynamic brake, and automatic means for applying the brakes successively and releasing one brake when the other is applied.

1,005,237. ALTERNATING-CURRENT ELECTROMAGNETIC SWITCH. David Larson, Yonkers, N. Y., assignor to Otis Elevator Co. Filed Nov. 26, 1907. Combined with a vertical base is a bracket secured thereto, and an electromagnet beneath the bracket and removably secured thereto with its pole faces in a plane parallel with the base.

1,005,252. VEHICLE BRAKING SYSTEM. Joseph N. Mahoney, Wilkinsburg, Pa., assignor to Westinghouse Air Brake Co. Filed March 25, 1907. Renewed Aug. 16, 1911. Includes an electrically controlled admission valve to the air brake cylinder.

1,005,253. REFILLABLE CARTRIDGE-FUSE. Edward B. Mallory, Wilkinsburg, Pa. Filed June 17, 1911. Between the inner ends of a pair of knife-edge terminals is secured a replaceable fuse element. Surrounding this is an insulating casing that has its ends closed by slotted washers and screw caps.

1,005,259. ELECTROMECHANICAL INDICATOR. Patrick F. McAvinney, Boston, Mass., assignor to Coffin Valve Co., Boston, Mass. Filed Dec. 21, 1910. Includes a pair of solenoids governed by an electric controller and actuating a pointer on a dial through a train of gearing.

1,005,260. ELECTROMECHANICAL CONTROLLER. Patrick F. McAvinney, Boston, Mass., assignor to Coffin Valve Co. Filed Dec. 21, 1910. The controller is arranged to open and close a valve and incidentally to actuate an indicator to show the valve motions.

1,005,283. SPRING BINDING-POST. Levi M. Neher, Milford, Ind., assignor to Fahnestock Electric Co. Filed Feb. 11, 1908. Consists of a single sheet of spring metal looped on itself with

the ends forming co-operating tongue and slot with wire-receiving holes.

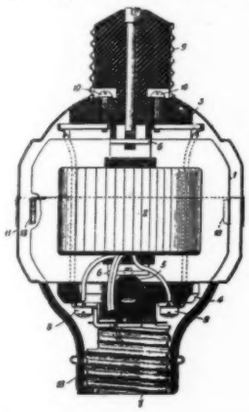
1,005,293. REGULATION OF THE VOLTAGE OF ALTERNATING-CURRENT MACHINES. Charles Algernon Parsons and Alexander Henry Law, Newcastle-upon-Tyne, England, said Law assignor to said Parsons. Filed Sept. 16, 1910. Comprises a leakage path between the alternator field poles and an indicator rotating synchronously with the frequency of the alternator current, and adapted to vary the strength of the current in the winding on the leakage path in accordance with changes in the load or power-factor of the alternator.

1,005,307. OUTDOOR TRANSFORMER. Karl C. Randall, Edgewood Park, Pa., assignor to Westinghouse Electric & Manufacturing Co. Filed Oct. 18, 1909. Combined with the transformer-inclosing tank is a shield for intercepting the direct rays of the sun, comprising a tubular portion spaced from the sides and bottom of the tank and a roof portion having ventilating openings.

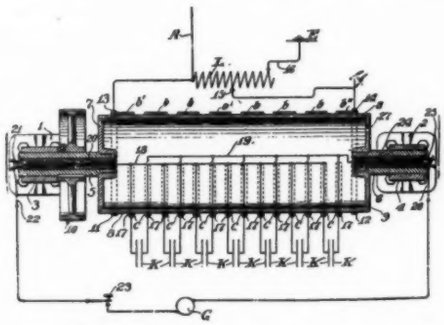
1,005,316. CONTACT-FINGER. Edward E. Rose, Swissvale, Pa., assignor to Westinghouse Electric & Manufacturing Co. Filed Feb. 2, 1907. A resilient finger has a rounded contact block in its end adapted to engage segmented commutator.

1,005,319. ELECTRIC MASSAGE-VIBRATOR. Charles C. Ruprecht, Cleveland, Ohio, assignor to Cleveland Vibrator & Electrical Co., Cleveland, O. Filed Feb. 1, 1908. Consists of a motor-driven shaft having an eccentric between a pair of spring arms secured to the applicator arm.

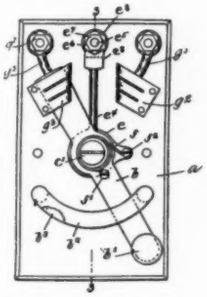
1,005,338. TRANSMITTING APPARATUS. Harry Shoemaker, Jersey City, N. J., assignor to International Telegraph Construction Co. Filed June 17, 1905. In a wireless signaling system the transmitting apparatus comprises a number of condensers, a source of energy, an oscillation circuit having no spark gap and having a period equal to the period of the transmitted energy, and a commutator for bringing the condensers alternately into communication with the source of energy and the oscillation circuit.



1,005,163.—LAMP TRANSFORMER.



1,005,338.—CONDENSER COMMUTATOR FOR WIRELESS TRANSMITTER.



1,005,402.—SWITCH.

1,005,350. CONTROLLER. Harry A. Steen, Pittsburgh, Pa., assignor to Westinghouse Electric & Manufacturing Co. Filed July 8, 1909. Renewed March 20, 1911. An operating lever arranged to work in any one of a number of parallel planes moves any one of several controller drums or all simultaneously. This selective action is accomplished through intermediate gearing.

1,005,355. VARIABLE-SPEED MOTOR-CONTROLLING APPARATUS. August Sundh, Yonkers, N. Y., assignor to Otis Elevator Co., Jersey City, N. J. Filed Mar. 13, 1908. An induction motor arranged with starting resistance, has a direct-current generator connected to the rotor. Automatic means are provided for substantially simultaneously varying the starting resistance and the current produced by the generator, to effect a retardation of the motor in proportion to its speed.

1,005,357. COOKING APPLIANCE. Alexander L. Sykes, Covington, Ky., assignor to A. L. Sykes Manufacturing Co., Cincinnati, O. Filed May 16, 1910. Inside an insulated box, an electric heater is fixed, the terminals extending through the box bottom. The shallow bottom of the box fits telescopically on an elongated cover, which is easily removable.

1,005,360. ELECTRIC HEATING DEVICE AND METHOD OF CONSTRUCTING THE SAME. Harold B. Taylor, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Co. Filed Dec. 31, 1908. Comprises a zig-zag resistance ribbon, sheets or strips of insulating material, and thin metal plates which are maintained under tension and compression, respectively, to clamp the resistance ribbon and the insulating material between them.

1,005,393. TELEPHONE SYSTEM. Charles S. Winston and Edwin H. Rupe, Chicago, Ill., assignors to Kellogg Switchboard & Supply Co., Chicago, Ill. Filed Dec. 19, 1904. The combination with telephone lines of different kinds, of a cord circuit adapted for use with the different kinds of lines, a supervisory signal associated with the cord circuit controlled over the limbs of the talking circuit of the telephone line in series and effaced when direct current flows during a connection and having the same method of operation when the cord is connected with the different kinds of lines.

1,005,402. ELECTRIC SWITCH. Alfred A. Ziegler, Boston, Mass. Filed Feb. 16, 1910. A pivoted switch member acts with two stationary members, these having a recess between them to receive and permit passage of the end portion of the switch arm, the end portion of the switch arm being made wider than the spaces between the body piece and the stationary switch members.

1,005,418. SIGNAL-CONTACT. Edward R. Cunningham, Des Moines, Iowa, assignor of one-third to E. B. Beighler and one-third to Frank C. Tate. Filed Sept. 3, 1910. Plates having sides arranged at an angle to each other are hinged to the housing so that one side of each plate will engage the trolley wheel and the other side of each plate will engage the housing and limit the movement of the plate toward the trolley wheel. Springs secured to the housing engage the plates normally forcing them toward the trolley wheel.

1,005,420. APPARATUS FOR CONTROLLING MOTORS. Frederic W. Darlington, Philadelphia, Pa. Filed Dec. 14, 1909. The control switches in the circuits of several cars are simultaneously actuated by pneumatic means.

1,005,429. OSCILLATING FAN. Emil E. Hollander and Carl M. Peterson, Arlington, N. J. Filed Jan. 12, 1911. An adjustable fan is oscillated by a crank and gear wheel driven from the shaft of the motor.

1,005,430. BLUE-PRINT WASHING AND DRYING MACHINE. Oscar Hoops, New York, N. Y. Filed Aug. 27, 1910. The machine is driven by an electric motor.

1,005,445. ELECTRIC-CAR CONTROLLER. Henry T. Maib and Earl O. Rowe, Spokane, Wash. Filed Dec. 22, 1910. An armature operated by an electromagnet is so arranged as to render the breaker inoperative when the electromagnet is energized.

1,005,471. ANTENNA. Ragnar H. Rendahl, Liljehelmen, near Stockholm, Sweden. Filed June 7, 1910. Thin metal tubes of large diameter are strung on the wires, electrically conducting metals being contained in each tube to make good contact between tube and wire.

1,005,475. THERMAL ELECTRICAL PROTECTOR. Charles A. Rolfe, Adrian, Mich., assignor to Rolfe Electric Co., Rochester, N. Y. Filed April 21, 1902. The combination with a circuit-controlling device, of a plurality of devices co-operating with it, means for connecting any one of them in circuit, and means for restoring each of the devices to operative condition.

1,005,482. ELECTIC SIGN AND METHOD FOR MAKING THE SAME. Herman A. Schmidt, Chicago, Ill., assignor of sixtenths to Aaron M. Searles, Chicago, Ill. Filed Jan. 31, 1910. A Crookes tube suitably bent is embedded in plastic material. The plastic material adjacent to the tube provides a convex curve of meniscus shape which acts as a reflector.

1,005,483. DEVICE FOR CUTTING SLEET FROM TROLLEY WIRES. Eugene Slingluff, Cincinnati, O., assignor of one-half to Erastus F. Kirk, Cincinnati, O. Filed April 29, 1910. A cutter rotates between two plates which are affixed to the trolley harp.

1,005,506. TERMINAL CONNECTOR OR COUPLING FOR ELECTRIC CONDUITS. William S. Brown, New York, N. Y. Filed May 16, 1910. Is a hollow, rigid, metallic connector which may be expanded to fit cables of various sizes.

1,005,517. FUSE. Albert F. Daum, Pittsburgh, Pa. Filed Nov. 23, 1910. The cartridge is divided by a partition in the middle, this partition being provided with a bar which works loosely.

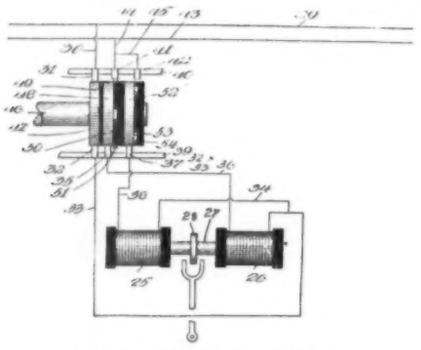
Both the partition and bar are pierced by a hole through which the fuse extends. When the fuse is blown the bar is pressed inward by a spring, giving an indication of the break in the circuit. Screw caps on the end of the cartridge provide for replacement of the fuse.

1,005,521. CUT-OUT. Herman W. Doughty and Clarence E. Beach, Binghamton, N. Y., assignors to Star Electric Co. Original application filed Oct. 16, 1900. Divided and this application filed Nov. 9, 1908. A moving insulating block slides between two insulating terminal blocks, forming a shield. Contact plates form a connection between terminals, another contact plate being so arranged that it will maintain a connection between two of the terminals mounted in one of the terminal blocks except when the movable block is in a position where the other contacts rest upon their respective terminals.

1,005,575. AUTOMATIC CIRCUIT-BREAKER. Estelle C. Raney, Crooksville, and Charles E. Simmons, Steubenville, O. Filed Oct. 10, 1908. The main switch is operated by a solenoid, this being controlled by the motor circuit. An overload switch in the circuit of the solenoid is also controlled by the motor circuit, a holding coil co-operating with the overload switch being controlled by a shunt circuit. A retarding device is provided for the overload switch, the main switch serving when in one position to close the main circuit and when in another position to close the shunt circuit.

1,005,612. ELECTRICAL VIBRATING DEVICE. Harry N. Cupp, Mars, Pa. Filed Sept. 7, 1910. Comprises a pair of solenoids, a reciprocating core and rotating element which alternately connects the coils with the source of energy, so as to cause the reciprocating core to vibrate.

1,005,628. METHOD OF MAKING COMPOUND METAL ARTICLES. Henry W. Fisher, Pittsburgh, Pa., assignor to Standard Underground Cable Co. Filed June 16, 1909. One metal is deposited and united with others from an electrolyte maintained at a temperature as high as the melting point of the metal so deposited, submerging the electroplated surface of the article so electroplated in a bath of flux and displacing such flux with a body of molten metal.



1,005,612.—VIBRATING DEVICE.

1,005,635. ALL-PORCELAIN ELECTRICAL LAMP-SOCKET. Edgar H. Freeman, Trenton, N. J. Filed April 1, 1910. Has a two-part switch frame consisting of a folded-contact member having a longitudinally arranged spring contact for the switch block and an angularly arranged bearing arm, and a separate bearing member formed of a slotted plate receiving the looped part of the folded contact member.

1,005,638. MOTOR-CONTROL SYSTEM. Homer E. Frost, Cleveland, O., assignor to Electric Controller & Manufacturing Co., Cleveland, O. Filed Oct. 1, 1910. Comprises a series of switches adapted to close in a predetermined sequence, actuating windings for the switches and a limit switch for short-circuiting a part of each of the windings to prevent their closure when the said limit switch is closed.

1,005,653. AGITATOR IMPLEMENT. Frederick J. Osius, Racine, Wis. Filed Sept. 20, 1910. A motor with a vertical shaft is mounted on a post in such a manner as to be easily adjustable in a vertical position. The shaft is fitted with a disk which is used for agitating drinks sold at soda fountains, etc.

1,005,671. ELECTROLYTIC DEVICE. Wilfred Bertram Thorpe, Balham, London, England. Filed Jan. 12, 1909. Comprises a tube having an electrolytic cell, a movable piston subject to the pressure of the evolved gases and formed by a column of mercury and means for producing a fluid-tight joint between the mercury and the inner surface of the tube.

1,005,672. ELECTROLYTIC APPARATUS. Wilfred Bertram Thorpe, Balham, London, England. Filed Aug. 18, 1909. Comprises an electrolytic cell closed in a gas-tight manner at its upper end and adapted to admit of depression of the electrolyte therein under the action of the evolved and collected gases, and an electric terminal arranged to dip into the electrolyte and to form a spark gap therewith upon depression below the terminal by the evolved gases.

1,005,700. CONTROL SYSTEM FOR ELECTRIC MOTORS. Frederick R. Fishback, New York, N. Y., assignor to Electric Controller & Manufacturing Co., Cleveland, O. Filed Feb. 28, 1910. Has a circuit for connecting the motor to a source of supply, and resistance switches to vary the resistance in the circuit, some of the switches being arranged so that, when closed the second time, a different amount of the resistance is connected in circuit than when closed the first time.

1,005,714. CABLE DUPLEX SYSTEM. Isidor Kitsee, Philadelphia, Pa. Filed Dec. 22, 1908. Renewed Mar. 1, 1911. Comprises two transformers for transmitting and receiving current impulses, and a receiving device. One winding of each transformer is connected in the line or cable, a second winding being connected to the receiving device. The source of current is connected in shunt to one transformer winding. Impulses sent alternate in polarity.

1,005,715. TELEGRAPHY. Isidor Kitsee, Philadelphia, Pa. Filed Dec. 19, 1908, Serial No. 468,267. Renewed March 9, 1911. Two windings control signal-reproducing means, a pair of opposed sources of energy being associated with each winding. Similar sources of different pairs are of different powers and are opposed to each other with respect to one of the windings, the winding being of relatively low resistance. A single key controls the sources for impressing currents of different polarities upon the line or cable.

1,005,718. ARRANGEMENT OF ELECTRODES FOR THE ELECTROLYTIC REFINING OF METALS. Frederich Max Kohler, St. Petersburg, Russia. Filed Dec. 28, 1909. Anodes consisting of the metal to be refined are held in a frame, the anodes and frame forming a container for the electrolyte. A cathode is arranged in the container, and pipes are provided for the supply and discharge of electrolyte.

1,005,725. ELECTRIC FURNACE. Georges Massip, Paris, France. Filed Sept. 23, 1910. The inner surface of the furnace is made of a refractory material which is a non-conductor when cold. Heating coils are embedded in the hearth material. A movable electrode is arranged within the furnace.

1,005,754. ELECTRICAL WATER-HEATER. Milton H. Schoenberg, San Francisco, Cal. Filed Apr. 29, 1911. Comprises a casing having a heating chamber provided with inlet and outlet openings, electric heating coils in the chamber, a metal supply cock connected with the inlet, a metal discharge pipe with the outlet, and a short-circuiting plate fixed to the casing and connecting the metal parts.

1,005,758. PROCESS AND APPARATUS FOR TESTING ELECTRIC METERS. Edgar M. Wilkins, Mexico City, Mex. Original application filed Aug. 12, 1907. Divided and this application filed March 20, 1908. Renewed March 18, 1911. A point on the rotating part of the meter is marked, a mark also being made on the adjacent fixed part. A correct meter, whose time of rotation is the same as that of the first would be if correct, has a mirror affixed to its rotating part. The momentary reflection of the sucessive positions of the rotating spot relative to the fixed one are noted in the reflection of the mirror and conclusions are derived as to the relative rates of rotation of the meters.

1,005,762. FUSE-ADJUSTING KEY.. Friedrich Ziegenfuss, Essen-on-the-Ruhr, Germany, assignor to Fried. Krupp Aktiengesellschaft, Essen-on-the-Ruhr, Germany. Filed Oct. 7, 1907. Has setting members provided with means for coupling them to the fixed and movable parts respectively of the fuse, and a manually releasable bolt constructed to engage and co-operate with the fuse and hold the key against displacement in the direction of the axis of the fuse.

1,005,774. OPERATING MECHANISM FOR ADDING-MACHINES. Francis R. Hoyt, Poplar Bluff, Mo., assignor to Dalton Adding Machine Co., St. Louis, Mo. Filed April 25, 1910. Has an arm attached to the main shaft, a link pivoted to the arm, an armature pivoted to the link, electric mechanism for moving the armature effectively to rock the shaft, a full-stroke device, and a link connecting the armature with the full-stroke device.

PATENTS WHICH HAVE EXPIRED.

Following is a list of the electrical patents (issued by the United States Patent Office) that expired October 15, 1911:

527,414. ELECTRIC CABLE. Thomas J. Dewees, Palmyra, N. J.

527,415. DYNAMO-ELECTRIC MACHINE. Ezra Fawcett, Aliance, Ohio.

527,436. PRIMARY BATTERY AND PORTABLE ELECTRIC LAMP. Samuel W. McQuay, London, England.

527,528. ELECTRIC CLOCK. Carl Guilberg, Jersey City, N. J.

527,556. WEATHER PROTECTING COVERING FOR ELECTRICAL CONDUCTORS. Edwin J. Houston, Philadelphia, Pa.

527,559. ELECTRIC-ARC LAMP. Alfred H. Moses, Jr., St. Louis, Mo.

527,601. CONDUIT ELECTRIC RAILWAY. Oliver B. Finn, Philadelphia, Pa.

527,623. SHADE-HOLDER FOR INCANDESCENT LAMPS. Edgar A. Russell and Nathan W. Crandall, Wallingford, Conn.